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ABSTRACT

This document is intended to help education and training institutions deliver the Machine Tool Advanced Skills Technology (MAST) curriculum to a variety of individuals and organizations. MAST consists of industry-specific skill standards and model curricula for 15 occupational specialty areas within the U.S. machine tool and metals-related industries. This volume provides the MAST standards and curriculum for the computer-aided drafting and design specialty area. It is organized in the following sections: (1) a profile of Moraine Valley Community College (Illinois), the development center that produced these standards and curriculum; (2) a computer-aided drafting and design technician competency profile of job duties and tasks; (3) a computer-aided drafting and design technician duty, task, and subtask outline; (4) a course curriculum outline and course descriptions; (5) a technical workplace competencies and course crosswalk; and (6) a Secretary's Commission on Achieving Necessary Skills (SCANS) proficiencies course crosswalk. Individual syllabi for the following courses are provided: Composition I; Introduction to Computer Graphics; Introduction to Drafting; Technical Mathematics, Introduction to Machine Tools, Mechanical Detailing, Introduction to Computer-Aided Drafting; Drafting Seminar; Three-Dimensional Modeling and Rendering; Materials of Industry; Machine Elements; Tool Drafting; Hydraulics and Pneumatics; Trigonometric Functions; Mechanics, Heat, and Sound; Machine Design; Statics and Strength of Materials; Plant Engineering Drafting; Computer Assisted Design/Manufacturing Concepts; and Speech Fundamentals. Each course syllabus includes the following: course hours, course descriptions, prerequisites, required course materials, teaching and evaluation methods, lecture and laboratory outlines, course objectives for technical and SCANS competencies, and suggested references. Two appendixes contain industry competency profiles and the pilot program narrative. (KC)

ED 401 440

Machine Tool
Advanced
Skills
Technology

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COMMON GROUND: TOWARD A STANDARDS-BASED TRAINING SYSTEM FOR THE U.S. MACHINE TOOL AND METAL RELATED INDUSTRIES

VOLUME 10

COMPUTER-AIDED DRAFTING & DESIGN

of
a 15 volume set of Skills Standards
and
Curriculum Training Materials for the
PRECISION MANUFACTURING INDUSTRY

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COMMUNITY COLLEGE

Texas State
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Waco

*M*achine Tool *A*dvanced *S*kills *T*echnology Program

MAST

VOLUME 10

COMPUTER-AIDED DRAFTING & DESIGN

Supported by
The Office of Vocational and Adult Education
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September, 1996

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ACKNOWLEDGMENTS

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- U.S. Department of Education, Office of Vocational & Adult Education
- MAST Consortia of Employers and Educators

MAST DEVELOPMENT CENTERS
Augusta Technical Institute - Itawamba Community College - Moraine Valley Community College - San Diego City College (CACT) - Springfield Technical Community College - Texas State Technical College

INDUSTRIES
AB Lasers - AIRCAP/MTD - ALCOA - American Saw - AMOCO Performance Products - Automatic Switch Company - Bell Helicopter - Bowen Tool - Brunner - Chrysler Corp. - Chrysler Technologies - Conveyor Plus - Darr Caterpillar - Davis Technologies - Delta International - Devon - D. J. Plastics - Eaton Leonard - EBTEC - Electro-Motive - Emergency One - Eureka - Foster Mold - GeoDiamond/Smith International - Greenfield Industries - Hunter Douglas - Industrial Laser - ITT Engineered Valve - Kaiser Aluminum - Krueger International. - Laser Fare - Laser Services - Lockheed Martin - McDonnell Douglas - Mercury Tool - NASSCO - NutraSweet - Rapistan DEMAG - Reed Tool - ROHR, International - Searle - Solar Turbine - Southwest Fabricators - Smith & Wesson - Standard Refrigeration - Super Sagless - Taylor Guitars - Tecumseh - Teledyne Ryan - Thermal Ceramics - Thomas Lighting - FMC, United Defense - United Technologies Hamilton Standard

COLLEGE AFFILIATES
Aiken Technical College - Bevil Center for Advanced Manufacturing Technology - Central Florida Community College - Chicago Manufacturing Technology Extension Center - Great Lakes Manufacturing Technology Center - Indiana Vocational Technical College - Milwaukee Area Technical College - Okaloosa-Walton Community College - Piedmont Technical College - Pueblo Community College - Salt Lake Community College - Spokane Community College - Texas State Technical Colleges at Harlington, Marshall, Sweetwater

FEDERAL LABS
Jet Propulsion Lab - Lawrence Livermore National Laboratory - L.B.J. Space Center (NASA) - Los Alamos Laboratory - Oak Ridge National Laboratory - Sandia National Laboratory - Several National Institute of Standards and Technology Centers (NIST) - Tank Automotive Research and Development Center (TARDEC) - Wright Laboratories

SECONDARY SCHOOLS
Aiken Career Center - Chicopee Comprehensive High School - Community High School (Moraine, IL) - Connally ISD - Consolidated High School - Evans High - Greenwood Vocational School - Hoover Sr. High - Killeen ISD - LaVega ISD - Lincoln Sr. High - Marlin ISD - Midway ISD - Moraine Area Career Center - Morse Sr. High - Point Lamar Sr. High - Pontotoc Ridge Area Vocational Center - Putnam Vocational High School - San Diego Sr. High - Tupelo-Lee Vocational Center - Waco ISD - Westfield Vocational High School

ASSOCIATIONS

American Vocational Association (AVA) - Center for Occupational Research and Development (CORD) - CIM in Higher Education (CIMHE) - Heart of Texas Tech-Prep - Midwest (Michigan) Manufacturing Technology Center (MMTC) - National Coalition For Advanced Manufacturing (NACFAM) - National Coalition of Advanced Technology Centers (NCATC) - National Skills Standards Pilot Programs - National Tooling and Machining Association (NTMA) - New York Manufacturing Extension Partnership (NYMEP) - Precision Metalforming Association (PMA) - Society of Manufacturing Engineers (SME) - Southeast Manufacturing Technology Center (SMTC)

MAST PROJECT EVALUATORS

Dr. James Hales, East Tennessee State University and William Ruxton, National Tooling and Machine Association (NTMA)

SPECIAL RECOGNITION

Dr. Hugh Rogers recognized the need for this project, developed the baseline concepts and methodology, and pulled together industrial and academic partners from across the nation into a solid consortium. Special thanks and singular congratulations go to Dr. Rogers for his extraordinary efforts in this endeavor.

This report is primarily based upon information provided by the above companies, schools and labs. We sincerely thank key personnel within these organizations for their commitment and dedication to this project. Including the national survey, more than 3,000 other companies and organizations participated in this project. We commend their efforts in our combined attempt to reach some common ground in precision manufacturing skills standards and curriculum development.

This material may be found on the Internet at **http://machinetool.tstc.edu**

CATALOG OF 15 VOLUMES

VOLUME 1	EXECUTIVE SUMMARY STATEMENT OF THE PROBLEM MACHINE TOOL ADVANCED SKILLS TECHNOLOGY PROJECT PROJECT GOALS AND DELIVERABLES PROJECT METHODOLOGY PROJECT CONCLUSIONS AND RECOMMENDATIONS APPENDICES
VOLUME 2	CAREER DEVELOPMENT GENERAL EDUCATION REMEDIATION
VOLUME 3	MACHINING - CORE COURSES (MAC)
VOLUME 4	MANUFACTURING ENGINEERING TECHNOLOGY (MET)
VOLUME 5	MOLD MAKING (MLD)
VOLUME 6	WELDING (WLD)
VOLUME 7	INDUSTRIAL MAINTENANCE (IMM)
VOLUME 8	SHEET METAL (SML) AND COMPOSITES (COM)
VOLUME 9	TOOL AND DIE (TLD)
VOLUME 10	COMPUTER-AIDED DRAFTING AND DESIGN (CAD)
VOLUME 11	COMPUTER-AIDED MANUFACTURING AND ADVANCED CNC (CNC)
VOLUME 12	INSTRUMENTATION (INT)
VOLUME 13	LASER MACHINING (LSR)
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VOLUME 10
COMPUTER-AIDED DRAFTING & DESIGN TECHNOLOGY

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FOREWORD

For the past two decades United States manufacturing has struggled to adjust to the competitive pressures of the world marketplace and changing consumer demands. Industry response has often centered on computerization of different components of the manufacturing process, a strategy that has produced striking reductions in costs, shortening of product development cycles, and progress in adhering to exacting requirements of near-zero defect rates and inventories and submicron tolerances. Without computerization United States manufacturing would have been unable to keep pace with the world.

The field of drafting and design exemplifies the changes that computerization have produced in manufacturing today. Prior to the development of computer-aided drafting and design, manual drafts people might labor for weeks to produce a design of a product. Completion of the design, however, did not guarantee product success. Production of samples and testing was necessary and product redesign was often crucial to ensure a reliable finished output. Product development cycles, even for the simplest products, could last several months, far too long to be competitive in the changing world market.

Contemporary computer-aided drafting and design can cut the length of product development cycles by as much as 90 percent. The modern Computer-Aided Drafting and Design Technician can sit at a computer console and design a product in minutes. That virtual reality design can then be linked with sophisticated statistical software programs that test the product's viability. Modifications to the design necessitated by high defect rates or too large tolerances can be made by a few clicks of a mouse, all before any actual production has occurred. The final product design can then be directly downloaded to a computerized numerical control machine on the shop floor and production can begin immediately. What before took months or weeks, now takes moments. Computer-Aided Drafting and Design has entered the manufacturing mainstream.

Recognizing the need to increase the supply of new skilled workers in this and other occupations for the metal and metals-related industries, the U.S. Department of Education launched the Cooperative Demonstration Program (Manufacturing Technologies) as part of the National Skills Standards Act of 1994. The goal of the Department initiative was to foster the development and implementation of national skill standards and a training model for certificate and Associate of Science degree programs. In July 1994, a multi-state consortium of community colleges led by Texas State Technical College received a grant awarded by the Department under the initiative. The Machine Tool Advanced Skills Technology (MAST) consortium, which includes six of the nation's leading Advanced Technology Centers (ATCs), was formed to develop, test, and disseminate industry-specific skill standards and model curricula for the U.S. machine tool industry over a two year period. As part of the MAST consortium, Moraine Valley Community College in Illinois was tasked with developing and piloting skill standards and model curricula in the technical area of Computer-Aided Drafting and Design Technician.

The skill standards and curriculum are the result of numerous interviews with practitioners from industry (see Appendix A) and discussions with educators, managers, supervisors, and others involved with computer-aided drafting and design. Based on discussion with the other MAST consortium partners, the project presents the following definition of the new occupation:

COMPUTER-AIDED DRAFTING AND DESIGN TECHNICIAN: *The computer-aided drafting and design technician will plan, layout and prepare engineering drawings, parts lists, diagrams, and related documents from layouts, sketches, and notes using manual or computer-aided techniques following current industry and company standards.*

The Computer-Aided Drafting and Design Technician program designed and offered by Moraine Valley Community College is structured as a 23 course, two year program of study. In this two year program, the students progress through a broad spectrum of courses designed to give the student a solid foundation in technical mathematics, mechanical drafting, concepts of engineering design and analysis, and CAD/computer skills. The curriculum employs comprehensive hands-on training and practical, real-world problems designed to closely simulate a working environment. The present volume provides the occupational skills standards, project documentation, and course syllabi for education and training recommended as minimum preparation for an individual desiring to become a computer-aided drafting and design technician.

PARTNER OCCUPATIONAL SPECIALITY ASSIGNMENTS

Although each of the six partner college development centers possessed detailed expertise in each of the MAST 15 occupational specialities, a division of work was still very necessary to ensure completion of the project due to the enormity associated with industrial assessment and complete curriculum revision for each of the areas of investigation.

Each Collegiate Partner was responsible for development of a specialization component of the overall model. Information for the future direction of this specialization area was obtained from NIST Manufacturing Centers and/or national consortia, professional societies, and industrial support groups addressing national manufacturing needs. Each Collegiate Partner tested its specialization model utilizing local campus resources and local industry. Information gained from the local experience was utilized to make model corrections. After testing and modification, components were consolidated into a national model. These events occurred during the first year of the Program. During the second year of the Program, the national model was piloted at each of the Collegiate Partner institutions. Experience gained from the individual pilot programs was consolidated into the final national model.

What follows is a profile of the MAST development center which had primary responsibility for the compilation and preparation of the materials for this occupational specialty area. This college also had the responsibility for conducting the pilot program which was used as one of the means of validation for this program.

MAST DEVELOPMENT CENTER, PALOS HILLS, IL
Moraine Valley Community College
Center for Contemporary Technology

Dr. Vernon O. Crawley, President
Moraine Valley Community College
Dr. Richard Hinckley
Dean, Business and Industrial Technology
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Manufacturing in Moraine Valley

The metropolitan Chicago area, including northwestern Indiana, is among the most heavily industrialized areas of the United States. The neighboring Moraine Valley area is home to hundreds of the small- to medium-sized companies that supply the larger industrial concerns, including design, fabrication, metal-working and parts-assembly firms. The diversity of industry in the region and the continual need for qualified entry-level technicians and retraining of current workers has created a great demand for the development of industrial training and the services of Moraine Valley Community College and its Center for Contemporary Technology.

Moraine Valley Community College (MVCC) and the Center for Contemporary Technology (CTT)

Moraine Valley Community College (MVCC) is a public, postsecondary institution serving all or part of 26 communities in the southwest suburban area of Cook County, representing a population of more than 380,000. Located 25 miles southwest of downtown Chicago in Palos Hills, the college is the fourth largest community college in Illinois and serves a diverse student body drawn from the surrounding communities. The focal point for business and industry training in Moraine Valley is the 124,000 s.f. Center for Contemporary Technology (CTT). Opened in 1988, the Center is among the finest and most diverse advanced technology centers (ATC's) in the nation, with over $6 million of equipment and technology to provide training and education in Automated Manufacturing; Automotive Technology; Computer-Aided Design; Corrosion Mitigation; Electronics/Telecommunications; Environmental Control Technology; Information Management; Machining; Mechanical & Fluid Power Maintenance; Non-Destructive Evaluation; and Welding.

Development Team

- **Project Director**: Richard Hinckley, PhD., Dean of Instruction for Business and Industrial Technology and manager of the Center for Contemporary Technology, served as director for the MAST project.
- **Subject Matter Expert**: Charles H. Bales, Instructor of Mechanical Design/Drafting, had program responsibility for developing skill standards and course/program materials for the mechanical design/drafting component of the MAST project. Professor Bales also served as lead instructor for the MAST pilot program in Computer-Aided Drafting and Design (CADD) Technician.
- **Subject Matter Expert**: James E. Greer, MS Ed., Professor of Welding, was responsible for developing skill standards and course/program materials for the welding component of the MAST project. Professor Greer also served as lead instructor for the MAST pilot program in Welding.
- **Skills Validation Coordinator**: Richard Kukac, MPA, Associate Dean of Instruction of Business and Industrial Technology, coordinated the industry skills verification process for MAST and facilitated the industry validation sessions with teams of expert practitioners from each skill area.

THE MAST COMPETENCY PROFILE

Development of Competency Profiles at each of the MAST sites began with visits to representative companies for the purpose of surveying expert workers within the industry and occupational areas under investigation. Each site began the survey process by asking a subject matter expert in the targeted technical area, generally a member of their faculty, to employ a modified version of the generally-accepted DACUM (Developing A Curriculum) method to categorize the major skills needed to work in the selected occupation. As source materials, the college instructors drew on their professional knowledge and experience of current and future industry requirements. The initial skill standards developed by the subject matter experts underwent numerous internal reviews and revisions within each site, assuming final form as a series of structured survey and interview statements designed to elicit a simple yes or no response.

To determine an appropriate survey sample, each site compiled a database of their region's small and medium-sized manufacturers and searched for companies likely to employ workers in the targeted occupational area. The resulting cross-industry samples were sorted further to achieve a balance of technological capability and workforce size; the sample companies within each region were then asked to participate in the project. Willing respondents were scheduled for interviews.

During the company interviews, MAST staff asked expert workers to identify the primary duties and tasks performed by a typical worker and to consider the special skills and knowledge, traits and attitudes, and industry trends that will have an impact on worker training, employability, and performance both now and in the future. The interview results were analyzed to create individual profiles identifying the most common duties and skills required of workers at each company. Copies of individual company competency profiles are provided in Appendix A of this volume. These individual company Competency Profiles served two purposes. First, they showed, in a format that could be easily understood by both industry and educators, a picture of the occupational specialty at a given company at that particular time. Second, these individual company Competency Profiles furnished the company with a document for which they could claim ownership. This, in effect, made them "real" partners in the work of MAST.

Data for all companies were then aggregated to develop a composite Competency Profile of industry skill standards within the selected occupational specialty area of, as shown in the following pages.

These same duties and tasks were then included in both the Texas and National Surveys for further validation (see Volume 1). As a result of the surveys, additional refinements were made to the Competency Profiles. These changes were then incorporated into the individual course syllabi which were used for the pilot program.

The MAST Competency Profile for this occupational specialty area has been included on the following pages.

SKILLS AND KNOWLEDGE

MORAINE VALLEY COMMUNITY COLLEGE
MAST PROGRAM REPRESENTATIVES

DR. RICHARD C. HINCKLEY
Dean of Instruction
Business/Industrial Technology

RICHARD A. KUKAC
Site Coordinator

Moraine Valley
Community College

TRAITS AND ATTITUDES

TOOLS AND EQUIPMENT

CURRENT TRENDS/CONCERNS

COMPETENCY PROFILE
Computer-Aided Drafting & Design Technician

Conducted By
M.A.S.T.
Machine Tool Advanced Skills
Technology Program
and
Consortium Partners
(V.199J40008)

*M*achine Tool *A*dvanced *S*kills
*T*echnology Program

MAST

COMPUTER-AIDED DRAFTING & DESIGN TECHNICIAN... plan, layout and prepare engineering drawings, parts lists, diagrams, and related documents from layouts, sketches and notes using manual or computer-aided techniques following current industry and company standards.

	Duties	**Tasks**												
A	**Apply Mathematical Concepts**	A-1 Perform Basic Arithmetic Operations	A-2 Compute Unit Conversions	A-3 Perform Basic Trigonometric Operations	A-4 Use Cartesian Coordinate System	A-5 Use Polar Coordinate System								
B	**Demonstrate Fundamental Drafting Skills**	B-1 Use Drawing Media and Related Drafting Materials	B-2 Use Measuring Scales	B-3 Identify Drafting Line Styles and Weights	B-4 Prepare Title Blocks and Other Drafting Formats	B-5 Create Technical Sketches								
C	**Plan and Organize Activities**	C-1 Determine Scope of Drafting Assignment	C-2 Select Appropriate Drafting Techniques for Drawings	C-3 Maintain Supporting Documents										
D	**Prepare Mechanical Production Drawings**	D-1 Understand and Apply Mechanical Drawing Methods	D-2 Create Detail Drawings	D-3 Create Assembly Drawings	D-4 Perform Technical Lettering	D-5 Create Bill of Material/ Parts List	D-6 Apply Dimensions and Notes	D-7 Perform Dimensional Limits and Tolerances	D-8 Apply Current Drafting Standards to Dawings	D-9 Perform Drawing Revisons	D-10 Use Commercial and Vendor Data			
E	**Assist Engineering Personnel**	E-1 Understand Basic Design Procedures	E-2 Utilize Fasteners for Mechanical Applications	E-3 Utilize Power Transmission Elements for Mechanical Applications	E-4 Utilize Bearings for Mechanical Applications	E-5 Understand Basic Manufacturing Methods	E-6 Utilize Brakes and Clutches for Mechanical Applications	E-7 Design Shafts for Use in Mechanical Applications						
F	**Use CAD System**	F-1 Start and Exit Software Program	F-2 Demonstrate Proper File Management Techniques	F-3 Use Directory Structure	F-4 Exit Drawing File	F-5 Utilize Drawing Set-Up Procedures	F-6 Use Geometric Objects	F-7 Use Text for Drawing Annotation	F-8 Control Object Properties	F-9 Use Viewing/ Display Commands	F-10 Use Standard Parts and/or Symbol Libraries	F-11 Understand Procedure to Print/Plot a Drawing	F-12 Use Standard Layering Techniques	F-13 Create Mechanical CAD Drawings
		F-14 Create 3D Mechanical Models	F-15 Utilize CAD Drawing Data	F-16 Use Drawing Feature Attributes	F-17 Obtain 3D Model Property Data	F-18 Use CAD Dimensioning Features	F-19 Use Third-Party Software for CAD Enhancement	F-20 Perform CAD Customization Procedures						

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THE MAST TECHNICAL WORKPLACE COMPETENCY OUTLINE

The Competency Profiles derived from the industry survey process were returned to industry and faculty members at each MAST partner college for review. Reviewers were asked to identify specific sub-tasks within each block of Duties and Tasks in the Profile; MAST staff at each college broke the sub-tasks down further into the detailed steps required to actually perform the duties and tasks of the manufacturing process. It is these detailed skill standards that were then incorporated into development of the curriculum and piloted as a training program by each of the MAST colleges. All results for the specific occupational specialty area have been organized as an outline of the duties, tasks, and sub-tasks required to demonstrate technical competency in the workplace, as shown in the following pages.

As a result of the Texas and the National Surveys, additional refinements were made to the Competency Outlines. These changes were then incorporated into the individual course syllabi.

The MAST Technical Workplace Competency Outline for this occupational specialty area has been included on the following pages.

COMPUTER-AIDED DRAFTING & DESIGN TECHNICIAN
TECHNICAL WORKPLACE COMPETENCIES

COMPUTER-AIDED DRAFTING & DESIGN TECHNICIAN...*plan, layout and prepare engineering drawings, parts lists, diagrams, and related documents from layouts, sketches and notes using manual or computer-aided techniques following current industry and company standards.*

A. APPLY MATHEMATICAL CONCEPTS

1. Perform Basic Arithmetic Operations
    a. Add, subtract, multiply and divide real numbers
    b. Add, subtract, multiply and divide fractions
    c. Convert real numbers to fractional equivalents and vice versa
2. Compute Unit Conversions
    a. Convert English units to metric units and vice versa
    b. Calculate unit conversion ratios
3. Perform Basic Trigonometric Operations
    a. Use trigonometric functions to calculate angles
    b. Use trigonometric functions to calculate linear distances
4. Use Cartesian Coordinate System
    a. Plot absolute coordinate data
    b. Plot relative coordinate data
5. Use Polar Coordinate System
    a. Plot absolute coordinate data
    b. Plot relative coordinate data

B. DEMONSTRATE FUNDAMENTAL DRAFTING SKILLS

1. Use Drawing Media and Related Drafting Materials
    a. Select drawing media
    b. Select related drafting materials (e.g. pencil, triangles, lead,...)
2. Use Measuring Scales
    a. Identify types of scales
    b. Select appropriate scale
    c. Use scales to measure and transfer dimensions
3. Identify Drafting Line Styles and Weights (e.g., center, hidden, object, dimension)
    a. Identify line styles
    b. Apply line styles
4. Prepare Title Blocks and Other Drafting Forms
    a. Identify and prepare title block
    b. Identify and prepare bill of material/parts list
    c. Identify and prepare revision history block
    d. Identify and prepare tolerance block
5. Create Technical Sketches
    a. Identify and create orthographic drawings (single and multi-view)
    b. Identify and create axonometric drawings (iso-, tri- and dimetric)
    c. Identify and create perspective drawings (1, 2, and 3-point)
    d. Understand and apply techniques of sketching

C. PLAN AND ORGANIZE ACTIVITIES

1. Determine Scope of Drafting Assignment
    a. Understand completion date
    b. Identify number of drawings involved
    c. Identify assignment requirements
    d. Understand drawing responsibilities
2. Select Appropriate Drafting Techniques for Drawings
    a. Identify types of drawings required
    b. Identify types of materials needed
3. Maintain Supporting Documents
    a. Identify supporting documents involved
    b. Understand document filing system
    c. Understand document responsibilities

D. PREPARE MECHANICAL PRODUCTION DRAWINGS

1. Understand and Apply Mechanical Drawing Methods
    a. Understand and apply multi-view orthographic projection
    b. Understand and apply section views
    c. Understand and apply auxiliary views
2. Create Detail Drawings
    a. Understand and apply detail drawing methods
    b. Identify types of detail drawings
    c. Understand layout of detail drawings
    d. Identify individual parts for detailing
    e. Understand role of the manufacturing process in the detail drawings
    f. Identify part dimensions from drawings
3. Create Assembly Drawings
    a. Identify types of assembly drawings
    b. Understand and apply appropriate assembly drawing layout
    c. Understand and apply assembly drawing practices
4. Perform Technical Lettering
    a. Understand technical lettering styles
    b. Identify and apply technical lettering styles
    c. Identify and apply standard notations
5. Create Bill of Material/Parts List
    a. Identify components included in bill of material/parts list
    b. Identify commercially available components in assembly
    c. Identify non-commercially available custom components in assembly
    d. Understand format of a bill of material/parts list
6. Apply Dimensions and Notes
    a. Identify dimensioning systems
    b. Understand and apply current dimensioning standards
    c. Understand dimensioning terminology
    d. Understand and apply detail dimensioning practices
    e. Understand and apply assembly dimensioning practices
7. Apply Dimensional Limits and Tolerances
    a. Understand tolerancing procedures
    b. Identify types of tolerances

    c. Apply tolerances to features
    d. Compute tolerance ranges
    e. Understand inch fit system
    f. Understand metric fit system
    g. Apply fit specifications to features
    h. Compute fits from tabular data and vice versa
    i. Identify types of fits
8. Apply Current Drafting Standards to Drawings
    a. Understand relevant standards
    b. Identify sources of standards
    c. Reference standards
    d. Apply relevant standards
9. Perform Drawing Revisions
    a. Understand reason for revisions
    b. Apply revision notations
    c. Complete revision documentation
10. Use Commercial and Vendor Data
    a. Understand commercial supplier catalogs
    b. Understand vendor drawings

E. ASSIST ENGINEERING PERSONNEL

1. Understand Basic Design Procedures
    a. Identify design process
    b. Discuss application of design methods
2. Utilize Fasteners (e.g. screws, bolts, nuts, seals, springs, ...) for Mechanical Applications
    a. Select appropriate fasteners and springs for application
    b. Understand basic fastener and spring analysis
    c. Identify types of fasteners and springs
    d. Use supplier catalogs and standard references to select fasteners and springs for mechanical application
3. Utilize Power Transmission Elements (e.g. gears, cams, belts, chains, couplings, linkages, ...) for Mechanical Applications
    a. Select appropriate power transmission elements for application
    b. Understand basic power transmission element analysis
    c. Identify types of power transmission elements
    d. Use supplier catalogs and standard references to select power transmission elements for mechanical application
4. Utilize Bearings for Mechanical Applications
    a. Identify types of bearing devices
    b. Understand basic bearing device analysis
    c. Select appropriate bearing devices for applications
    d. Use supplier catalogs and standard references to select bearing devices for mechanical applications
5. Understand Basic Manufacturing Methods
    a. Identify types of manufacturing operation
    b. Understand application of manufacturing in drafting and design of machinery

- c. Prepare drawing for manufacturing application (e.g. casting drawings, forging drawings, ...)

6. Utilize Brakes and Clutches for Mechanical Applications
    - a. Identify types of brakes and clutches
    - b. Understand basic brake and clutch analysis
    - c. Select appropriate brakes and clutches for application
    - d. Use brakes and clutches
7. Design Shafts for Use in Mechanical Applications
    - a. Understand basic shaft analysis
    - b. Select appropriate shafts for applications
    - c. Use design shafts

F. USE COMPUTER-AIDED DRAFTING SYSTEM

1. Start and exit a software program
    - a. Understand starting procedures
    - b. Understand exiting procedures
2. Demonstrate Proper File Management Techniques
    - a. Explain file management techniques
    - b. Demonstrate file management procedures
    - c. Format a floppy disk
3. Use Directory Structure
    - a. Identify directories and sub-directories
    - b. Create and delete directories
4. Edit Drawing File
    - a. Create new drawing file
    - b. Open existing drawing file
5. Utilize Drawing Set-Up Procedures
    - a. Identify drawing set-up parameters
    - b. Perform drawing set-up
6. Use Geometric Objects (e.g. lines, splines, circles, ...)
    - a. Construct objects
    - b. Edit objects
    - c. Manipulate objects
7. Use Text for Drawing Annotation
    - a. Create text annotation
    - b. Edit text
8. Control Object Properties (color, line-type, ...)
    - a. Determine object property
    - b. Modify object property
9. Use Viewing/Display Commands
    - a. Demonstrate view commands
    - b. Create multiple viewing windows
    - c. Demonstrate 3-D display procedures
10. Use Standard Parts and/or Symbol Libraries
    - a. Create parts/symbols
    - b. Create symbol libraries
    - c. Use standard parts/symbol libraries
11. Understand Procedure to Print/Plot a Drawing

- a. Demonstrate plotting procedures
- b. Determine scaling and layout
- c. Use various printers and plotters

12. Use Standard Layering Techniques
    - a. Define standard layering procedures
    - b. Apply standard layering techniques
13. Create Mechanical CAD Drawings
    - a. Use CAD to create multi-view orthographic drawings
    - b. Understand 2-D multi-view drawing procedures on CAD system
14. Create 3-D Mechanical Models
    - a. Convert 2-D drawing information into 3-D
    - b. Create and edit wireframe model
    - c. Create and edit 3-D surface model
    - d. Create and edit 3-D solid model
15. Utilize CAD Drawing Data
    - a. Translate CAD drawings into data file formate (DXF, IGES)
    - b. Import data files into CAD drawings
    - c. Query CAD data files
16. Use Drawing Feature Attributes
    - a. Identify attribute data
    - b. Apply attribute data
    - c. Extract attribute data
17. Obtain 3-D Model Property Data
    - a. Identify surface properties (surface, volume)
    - b. Extract surface properties
    - c. Identify mass properties (mom. of inertia, centroids, center of gravity)
    - d. Extract mass properties
18. Use CAD Dimensioning Features
    - a. Identify dimensioning variables
    - b. Set dimensioning variables
    - c. Use dimension drawings using CAD
    - d. Use dimensioning standards with CAD
    - e. Modify CAD dimensions
19. Use Third-Party Software for CAD Enhancement
    - a. Identify third-party software
    - b. Use third-party software
20. Perform CAD Customization Procedures
    - a. Identify customization techniques and procedures
    - b. Use customization techniques and procedures

THE MAST PILOT PROGRAM CURRICULUM AND COURSE DESCRIPTIONS

After completing the Competency Profile and Technical Workplace Competency Outline for each occupational specialty area, each MAST partner reviewed their existing curricula against the industry-verified skill standards in order to identify a suitable foundation for new pilot training programs. Because each college had to comply with the requirements of its respective college system and appropriate state agency, the resulting pilot curricula for occupational specialty areas tended to vary in format and academic requirements (e.g., some programs were based on the semester system, others on the quarter system). Despite differences in the curricula developed at the partner colleges, each of the pilot programs was designed to achieve the following two goals mandated in the MAST grant proposal:

- Pilot Program: "Conduct a one year pilot program with 25 or more selected applicants at each college or advanced technology center to evaluate laboratory content and effectiveness, as measured by demonstrated competencies and indicators of each program area."

- Student Assessment: "Identify global skills competencies of program applicants both at point of entrance and point of exit for entry level and already-employed technicians."

(Note: All occupational specialty areas were not pilot tested at all Development Centers; however, all partner colleges conducted one or more pilot programs.)

Included on the following pages is the curriculum listing for the pilot program which was used to validate course syllabi for this occupational specialty area. This curriculum listing included course names and numbers from the college which conducted the pilot program. The curriculum also shows the number of hours assigned to each of the courses (lecture, lab and credit hours). Also included is a description of each of the courses.

COMPUTER-AIDED DRAFTING & DESIGN TECHNICIAN CURRICULUM

		LEC	LAB	CR
FIRST SEMESTER				
COM 101	Composition I	3	0	3
DFT 100	Introduction to Computer Graphics	0	4	2
DFT 101	Introduction to Drafting	3	4	4
MTH 135	Technical Mathematics	5	0	5
MTO 101	Introduction to Machine Tools	2	2	4
		13	10	18
SECOND SEMESTER				
DFT 110	Mechanical Detailing	2	3	3
DFT 145	Introduction to Computer-Aided Drafting	1	4	3
DFT 238	Drafting Seminar	1	0	1
MDT 160	3-D Modeling and Rendering	2	3	3
MET 104	Materials of Industry	2	0	2
	General Education Requirement	—	—	3
		8	10	15
THIRD SEMESTER				
MDT 205	Machine Elements	1	4	3
MDT 220	Tool Drafting	1	4	3
MDT 209	Hydraulics and Pneumatics	2	1	2
MTH 142	Trigonometric Functions	2	0	2
PHY 150	Mechanics, Heat and Sound	3	3	4
	General Education Requirement	—	—	3
		9	12	17
FOURTH SEMESTER				
MDT 255	Machine Design	2	3	3
MDT 210	Statics and Strength of Materials	1	4	3
MDT 213	Plant Engineering Drafting	1	4	3
MDT 270	CAD/CAM Concepts	1	4	3
COM 103	Speech Fundamentals	3	0	3
	General Education Requirement	—	—	3
		8	14	18
	Program Totals	35+	44+	68

COMPUTER-AIDED DRAFTING & DESIGN TECHNICIAN
COURSE DESCRIPTIONS

DFT 100	Introduction to Computer Graphics (0-4-2) The purpose of this course is to introduce some of the graphics capabilities of the personal computer. Students will be exposed to software that allows the creation of line drawings, in addition to the creative possibilities of a paint program. The capabilities of a word processor to accomplish desktop publishing will be examined. Also covered will be the ability to turn data into professional looking presentation graphics. A highlight of the course will be a look at an animation program.
DFT 101	Introduction to Drafting (3-4-4) Theory, technical skills, industrial applications and practices of technical sketching, engineering lettering, selection and use of equipment, geometric construction, multiviews, and auxiliary views.
DFT 110	Mechanical Detailing (2-3-3) Mechanical Detailing emphasizes the theory and development of mechanical drafting and geometric dimensioning and tolerancing as it is applied to industrial applications such as machine design and manufacturing techniques. Further development of technical skills and industrial applications in casting, forging, stamping, machining drawings, size and geometric tolerancing. Industrial references used as well as drafting room procedures, including revisions. Prerequisites: COM 101, Composition I, DFT 101, Introduction to Drafting, MTH 135, Technical Mathematics, MTO 101, Introduction to Machine Tools, or consent of instructor.
DFT 145	Introduction to Computer-Aided Drafting (1-4-3) The student will be introduced to Computer Aided Drafting and Design as an essential tool utilizing and enhancing the student's existing drafting skills. This is accomplished through the generation of two and three dimensional orthographic drawings, as well as pictorial techniques, in the CAD environment. Operating system commands, cursor manipulation, direct display interaction, geometry creation and manipulation, file storage and retrieval, entity manipulation such as rotation and mirroring, and the use of output devices such as printers and plotters are just a few of the hardware and software capabilities to be covered. Prerequisites: DFT 101, Introduction to Drafting, 15 hours in the Mechanical Design Drafting/CAD Program, or one year professional drafting experience. Corequisite: DFT 110, Mechanical Detailing.
DFT 238	Drafting Seminar (1-0-1) This course will discuss and address various problems encountered in the work place, including job searches, resumes and assessment of benefits and wage scales. Problems in dealing with subordinates, superiors, and equals and strategies for raises and promotions will be discussed in detail. Guest speakers will make presentations to explain selected fields within the drafting occupations.

MDT 160	**3-D Modeling & Rendering** (2-3-3) This course covers the basics of 3-D wire frames, surface modeling, solids modeling, and rendering. Students learn the concepts and techniques required to construct 3-D objects. These include 3-D coordinates, spherical coordinates, surface and solids modeling. User coordinate systems and multiple viewports are also discussed. Students construct a variety of objects using these techniques. Objects are rendered to slides and hard copy. Prerequisites: COM 101, Composition I, DFT 101, Introduction to Drafting, MTH 135, Technical Mathematics, MTO 101, Introduction to Machine Tools, or consent of instructor. Corequisite: DFT 145, Introduction to Computer-Aided Drafting.
MDT 205	**Machine Elements** (1-4-3) Machine elements and basic mechanisms are topics in this study. Gears, cams, bearings, splines, linkages and motion producing devices are specifically studied. Prerequisites: DFT 110, Mechanical Detailing, and DFT 145, Introduction to Computer-Aided Drafting. Corequisite: MDT 220, Tool Drafting.
MDT 209	**Hydraulics and Pneumatics** (2-1-2) The study of the basic theory and applications of hydraulic and pneumatic components and circuits. Special attention is given to the application and design use of hydraulics and pneumatics for power transmission and the control of industrial processes. Prerequisites: PHY 150, Mechanics, Heat and Sound, and MTH 135, Technical Mathematics. Corequisite: MDT 255, Machine Design.
MDT 210	**Statics and Strength of Materials** (1-4-3) Introduces statics and the study of internal stresses in machine members. Equilibrium calculations for loaded beams, columns, and machine structures, static and strengths analysis of bolted and riveted joints, and pressure vessels. Moments of inertia, center of gravity and centroids are computed, and static and kinetic friction are discussed. Standard reference tables are used throughout. Prerequisites: MDT 205, Machine Elements, MTH 142, Trigonometric Functions, and PHY 150, Mechanics, Heat and Sound.
MDT 213	**Plant Engineering Drafting** (1-4-3) Piping layouts, symbols and detailing; electrical drafting of wiring diagrams, welding drafting and structural detailing and materials. Prerequisites: DFT 145, Introduction to Computer-Aided Drafting, MDT 220, Tool Drafting, and MTH 135, Technical Mathematics.
MDT 220	**Tool Drafting** (1-4-3) Introduction to die design, jig design, drawing theory, industrial applications, technical skills and typical practices in tool drawings. Prerequisite: DFT 110, Mechanical Detailing.
MDT 255	**Machine Design** (2-3-3) This course covers the basics of machine design including the design process, types of machines and mechanisms, and the application of machine elements in the design. Computer-aided drafting and design applications are discussed and utilized. Prerequisites: DFT 145, Introduction to Computer-Aided Drafting, and MDT 205, Machine Elements. Corequisite: MDT 210, Statics and Strength of Materials.

MDT 270 CAD/CAM Concepts (1-4-3) Theory and concepts in the fundamentals of programming a CAD based system to generate numerical control programs for production machinery. Creation of tool databases, machining curves and tool paths for lathes and mills are covered, in addition, tool and turret statements, machine characteristics, post processors and tape utilities are covered. Machining of parts is not included in this fundamental course. Prerequisites: DFT 145, Introduction to Computer-Aided Drafting, MDT 160, 3-D Modeling and Rendering, or consent of instructor.

COMPUTER-AIDED DRAFTING & DESIGN TECHNICIAN
SUPPORT COURSES

COM 101	Composition I (3-0-3) Designed to teach clear and effective writing, with emphasis on organizational patterns, style, the research paper, and types of composition. The purpose of this course is to help students learn how to use writing to discover and clarify what they think, feel, or believe; to effectively communicate to others in expository and argumentative prose what they think, feel, or believe; to develop critical thinking skills of observation, analysis, synthesis, and evaluation; and to develop a coherent essay within a limited time frame. Prerequisite: Grade of "C" or better in COM 090, Paragraph and Theme Writing, or appropriate score on placement test.
COM 103	Speech Fundamentals (3-0-3) Introduction to basic oral communication principles and skills, challenges of cultural diversity and gender equity. Includes study and practice in public speaking and discussion, preparation and organization, and delivery techniques. This course satisfies the requirements of Public Act 87-581.
MET 104	Materials of Industry (2-0-2) Introduces types and uses of industrial materials. Three general classifications of materials (ferrous metals, nonferrous metals, and composites) are studied emphasizing manufacture, properties, and industrial applications.
MTH 135	Technical Mathematics (5-0-5) Topics in algebra with physical applications. Recommended for students in the electronics, non-destructive evaluation and mechanical design programs. Prerequisite: two years of high school math, including algebra, and appropriate placement test score, or MTH 095, Beginning Algebra with Geometry, with a grade of "C" or better.
MTH 142	Trigonometric Functions (2-0-2) This course is a study of the trigonometric functions, inverse trigonometric functions and appropriate applications. The concepts that will prepare a student for calculus are emphasized. Prerequisites: three years of high school math, including advanced algebra, and appropriate placement test score, or MTH 135, Technical Mathematics, or MTH 141, College Algebra (Functions), or concurrent registration in MTH 141, College Algebra (Functions).
MTO 101	Introduction to Machine Tools (2-2-3) General introduction to machining as a foundation technology in manufacturing. Introduction to the theory and operation of drilling, milling, and turning machines. Introduction to speeds and feeds. Introduction to precision measurement.
PHY 150	Mechanics, Heat and Sound (3-3-4) This general college physics course for liberal arts or science majors covers motion, momentum, work, power, energy, fields, heat and forces. Prerequisites: two years of high school algebra or MTH 101, Intermediate Algebra.

THE MAST TECHNICAL WORKPLACE COMPETENCY/COURSE CROSSWALK

Upon development of appropriate curricula for the pilot programs, each MAST college began to develop individual course outlines for its assigned specialty area. The skill standards identified in the Competency Profile were cross walked against the technical competencies of the courses in the pilot curriculum. The resulting matrix provided a valuable tool for assessing whether current course content was sufficient or needed to be modified to ensure mastery of entry level technical competencies. Exit proficiency levels for each of the technical competencies were further validated through industry wide surveys both in Texas and across the nation.

The Technical Workplace Competency/Course Crosswalk in the following pages presents the match between industry-identified duties and tasks and the pilot curriculum for . Course titles are shown in columns, duties and tasks in rows. The Exit Level Proficiency Scale, an ascending scale with 5 the highest level of proficiency, includes marked boxes indicating whether the task is covered by the instructor during the course; the numbers 1-5 indicate the degree of attention given to the task and the corresponding proficiency expected on the part of the student. The crosswalk is intended to serve as an aide to other instructional designers and faculty in community college programs across the nation.

Included on the following pages is the Technical Workplace Competency/Course Crosswalk for the pilot program curriculum. This crosswalk validates the fact that the duties and tasks which were identified by industry as being necessary for entry level employees have been incorporated into the development of the course syllabi.

Page 1

Technical Workplace Competencies/Course

CROSSWALK

TECHNICAL COMPETENCY COMPUTER-AIDED DRAFTING & DESIGN TECHNICIAN

	Intro. to Computer Graphics	Introduction to Drafting	Technical Mathematics	Intro. to Machine Tools	Mechanical Detailing	Intro. to CAD		3-D Modeling & Rendering	Materials of Industry	Machine Elements	Tool Drafting	Hydraulics and Pneumatics	Trigonometric Functions	Mechanics, Heat and Sound	Machine Design	Statics & Strength of Mat.	Plant Engineering Drafting	CAD/Cam Concepts		EXIT PROFICIENCY LEVEL
A. APPLY MATHEMATICAL CONCEPTS																				
A-1 Perform Basic Arithmetic Functions	X	X	X	X	X	X		X	X	X	X	X	X	X	X	X	X	X		4
A-2 Compute Unit Conversions	X	X	X	X	X	X		X	X	X	X	X	X	X	X	X	X	X		4
A-3 Perform Basic Trigonometric Operations			X	X						X			X	X	X	X				4
A-4 Use Cartesian Coordinate System	X	X	X	X	X	X		X	X	X	X	X	X	X	X	X	X	X		4
A-5 Use Polar Coordinate System	X	X	X	X	X	X		X	X	X	X	X	X	X	X	X	X	X		4
B. DEMONSTRATE FUNDAMENTAL DRAFTING SKILLS																				
B-1 Use Drawing Media and Related Drafting Materials	X	X			X	X		X		X	X				X		X	X		4
B-2 Use Measuring Scales		X		X	X						X				X		X	X		4
B-3 Identify Drafting LineStyles and Weights (e.g., center, hidden, object, dimension)	X	X			X	X		X			X				X		X	X		4
B-4 Prepare Title Blocks and Other Drafting Forms		X			X	X		X		X	X				X		X	X		4
B-5 Create Technical Sketches		X			X	X		X		X	X				X		X	X		4
C. PLAN AND ORGANIZE ACTIVITIES																				
C-1 Determine Scope of Drafting Assignment	X	X			X	X		X		X	X				X		X	X		4
C-2 Select Appropriate Drafting Techniques for Drawings	X	X			X	X		X		X	X				X		X	X		4
C-3 Maintain Supporting Documents					X					X	X				X		X	X		2
D. PREPARE MECHANICAL PRODUCTION DRAWINGS																				
D-1 Understand and Apply Mechanical Drawing Methods		X		X	X	X		X		X	X				X		X	X		4
D-2 Create Detail Drawings					X						X				X			X		3
D-3 Create Assembly Drawings					X			X			X				X			X		4
D-4 Perform Technical Lettering		X			X					X	X				X		X	X		4
D-5 Create Bill of Material/Parts List					X					X	X				X		X			3
D-6 Apply Dimensions and Notes		X			X					X	X				X		X			4
D-7 Apply Dimensional Limits and Tolerances					X					X	X				X		X			4
D-8 Apply Current Drafting Standards to Drawings		X			X					X	X				X		X			4
D-9 Perform Drawing Revisions					X					X					X		X			3
D-10 Use Commercial and Vendor Data		X			X					X	X				X		X			2
E. ASSIST ENGINEERING PERSONNEL																				
E-1 Understand Basic Design Procedures															X					3
E-2 Utilize Fasteners (e.g., screws, bolts, nuts, seals, springs, ...) for Mechanical Applications		X			X					X	X				X		X			3

Technical Workplace Competencies/Course

CROSSWALK

TECHNICAL COMPETENCY
COMPUTER-AIDED DRAFTING & DESIGN TECHNICIAN

	Intro. to Computer Graphics	Introduction to Drafting	Technical Mathematics	Intro. to Machine Tools	Mechanical Detailing	Intro. to CAD		3-D Modeling & Rendering	Materials of Industry	Machine Elements	Tool Drafting	Hydraulics and Pneumatics	Trigonometric Functions	Mechanics, Heat and Sound	Machine Design	Statics & Strength of Mat.	Plant Engineering Drafting	CAD/Cam Concepts		EXIT PROFICIENCY LEVEL
E-3 Utilize Power Transmission Elements (e.g., gears, cams, belts, chains, couplings, linkages, ...) for Mechanical Applications										X					X					2
E-4 Utilize Bearings for Mechanical Applications										X					X					3
E-5 Understand Basic Manufacturing Methods				X	X				X		X				X			X		3
E-6 Utilize Brakes and Clutches for Mechanical Applications															X					3
E-7 Design Shafts for Use in Mechanical Applications															X	X				2
F. USE COMPUTER-AIDED DRAFTING SYSTEM																				
F-1 Start and Exit a Software Program		X	X			X		X	X		X	X					X	X		4
F-2 Demonstrate Proper File Management Techniques	X	X			X	X		X		X	X						X	X		4
F-3 Use Directory Structure	X	X			X	X		X		X	X						X	X		4
F-4 Edit Drawing File	X	X			X	X		X		X	X						X	X		4
F-5 Utilize Drawing Set-Up Procedures		X			X	X		X		X	X						X	X		4
F-6 Use Geometric Objects (e.g., lines, splines, circles, ...)	X	X			X	X		X		X	X						X	X		4
F-7 Use Text for Drawing Annotation	X	X			X	X		X		X	X						X	X		4
F-8 Control Object Properties (color, line-type, ...)	X	X			X	X		X		X	X						X	X		4
F-9 Use Viewing/Display Commands	X	X			X	X		X		X	X						X	X		4
F-10 Use Standard Parts and/or Symbol Libraries					X	X		X		X	X						X	X		4
F-11 Understand Procedure to Print/Plot a Drawing	X	X			X	X		X		X	X						X	X		4
F-12 Use Standard Layering Techniques		X			X	X		X		X	X						X	X		4
F-13 Create Mechanical CAD Drawings		X			X	X		X		X	X						X	X		4
F-14 Create 3D Mechanical Models						X		X										X		4
F-15 Utilize CAD Drawing Data								X										X		4
F-16 Use Drawing Feature Attributes						X														4
F-17 Obtain 3D Model Property Data								X										X		4
F-18 Use CAd Dimensioning Features		X			X	X				X	X						X	X		4
F-19 Use Third-Party Software for CAD Enhancement					X			X		X	X						X	X		3
F-20 Perform CAD Customization Procedures					X	X		X		X	X						X	X		4

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COMPUTER-AIDED DRAFTING & DESIGN TECHNICIAN
TECHNICAL WORKPLACE COMPETENCIES
EXIT LEVEL PROFICIENCY MATRIX

Computer-Aided Drafting & Design Technician:

> plan, layout and prepare engineering drawings, parts lists, diagrams, and related documents from layouts, sketches and notes using manual or computer-aided techniques following current industry and company standards.

The following matrix identifies the five exit levels of technical workplace competencies for the Computer-Aided Drafting & Design Drafting Technician Certificate at Moraine Valley Community College, Palos Hills, Illinois.

EXIT LEVEL OF PROFICIENCY					
Technical Workplace Competency	**1**	**2**	**3**	**4**	**5**
	rarely	routinely with supervision	routinely with limited supervision	routinely without supervision	initiates/ improves/ modifies and supervises others

THE MAST SCANS/COURSE CROSSWALK

The Secretary's Commission on Achieving Necessary Skills (SCANS), U. S. Department of Labor, has identified in its "AMERICA 2000 REPORT' the following five competencies and a three-part foundation of skills and personal qualities that are needed for solid job performance:

COMPETENCIES:

Resources:	Identifies, organizes, plans, and allocates resources
Interpersonal:	Works with others
Information:	Acquires and uses information
Systems:	Understands complex inter-relationships
Technology:	Works with a variety of technologies

FOUNDATION SKILLS:

Basic Skills:	Reads, writes, performs arithmetic and mathematical operations, listens and speaks
Thinking Skills:	Thinks creatively, makes decisions, solves problems, visualizes, knows how to learn and reasons
Personal Qualities:	Displays responsibility, self-esteem, sociability, self-management, and integrity and honesty

Recognizing the value of SCANS proficiencies to job performance, as well as the growing mandate in many states to include SCANS activities in course curricula, MAST asked survey respondents to review the SCANS skill sets in the context of the draft skill standards for each occupational specialty area. MAST also incorporated evaluation of SCANS competencies and foundation skills into its assessment of the pilot training curricula. The results were summarized in a crosswalk that allowed MAST staff to modify course content where needed to strengthen achievement of SCANS competencies.

The following pages present the SCANS/Course Crosswalk for the pilot curriculum in Courses are listed along the top and SCANS competencies and foundations are shown along the left side of the matrix. An exit level proficiency matrix for SCANS competencies and foundation skills is provided as well.

As "soft" skills, the SCANS competencies are inherently difficult to quantify. MAST realizes that some faculty will emphasize the SCANS more or less than others. The SCANS/Course Crosswalk matrix has been included with this course documentation to show the importance of these "soft skills" and the importance of their being addressed in the classroom (particularly in technical classes). In time, faculty will learn to make these types of SCANS activities an integral and important part of the teaching process.

Included on the following pages is the SCANS/Course Crosswalk for the pilot program curriculum. This crosswalk validates the fact that the "soft skills" (SCANS) which were identified by industry as being necessary for entry level employees have been incorporated into the development of the course syllabi. Also included is a matrix which defines the exit level of proficiency scale (1-5).

SCANS/Course

CROSSWALK

COMPUTER-AIDED DRAFTING & DESIGN TECHNICIAN

COMPETENCY		Intro. to Computer Graphics	Introduction to Drafting	Technical Mathematics	Intro. to Machine Tools	Mechanical Detailing	Intro. to CAD		3-D Modeling & Rendering	Materials of Industry	Machine Elements	Tool Drafting	Hydraulics and Pneumatics	Trigonometric Functions	Mechanics, Heat and Sound	Machine Design	Statics & Strength of Mat.	Plant Engineering Drafting	CAD/Cam Concepts		EXIT PROFICIENCY LEVEL
(RS) RESOURCES:																					
A. Allocates time		X	X	X	X	X	X		X	X	X	X	X	X	X	X	X	X	X		4
B. Allocates money																					
C. Allocates material and facility resources		X	X		X	X	X		X	X	X	X	X	X	X	X	X	X	X		4
D. Allocates human resources																					
(IN) INTERPERSONAL SKILLS:																					
A. Participates as a member of a team		X	X	X	X	X	X		X	X	X	X	X	X	X	X	X	X	X		4
B. Teaches others																					
C. Serves clients/customers																					
D. Exercises leadership																					
E. Negotiates																					
F. Works with cultural diversity																					
(IF) INFORMATION SKILLS:																					
A. Acquires and evaluates information		X	X	X	X	X	X		X	X	X	X	X	X	X	X	X	X	X		4
B. Organizes and maintains information		X	X	X	X	X	X		X	X	X	X	X	X	X	X	X	X	X		4
C. Interprets and communicates information		X	X	X	X	X	X		X		X	X	X	X	X	X	X	X	X		4
D. Uses computers to process information		X	X	X	X	X	X		X		X	X		X		X		X	X		4
(SY) SYSTEMS:																					
A. Understands systems		X	X	X	X	X	X		X	X	X	X	X	X		X		X	X		3
B. Monitors and corrects performance					X				X				X			X					2
C. Improves and designs systems									X							X					1
(TE) TECHNOLOGY:																					
A. Selects technology		X	X		X	X	X		X	X	X	X	X		X	X		X	X		3
B. Applies technology to task		X	X		X	X	X		X	X	X	X	X		X	X		X	X		3
C. Maintains and troubleshoots technology					X																2

SCANS/Course

CROSSWALK

COMPUTER-AIDED DRAFTING & DESIGN TECHNICIAN

FOUNDATION SKILLS	Intro. to Computer Graphics	Introduction to Drafting	Technical Mathematics	Intro. to Machine Tools	Mechanical Detailing	Intro. to CAD		3-D Modeling & Rendering	Materials of Industry	Machine Elements	Tool Drafting	Hydraulics and Pneumatics	Trigonometric Functions	Mechanics, Heat and Sound	Machine Design	Statics & Strength of Mat	Plant Engineering Drafting	CAD/Cam Concepts		EXIT PROFICIENCY LEVEL
(BS) BASIC SKILLS:																				
A. Reading	X	X	X	X	X	X		X	X	X	X	X	X	X	X	X	X	X		4
B. Writing	X	X	X	X	X	X		X	X	X	X	X	X	X	X	X	X	X		4
C. Arithmetic and mathematics	X	X	X	X	X	X		X	X	X	X	X	X	X	X	X	X	X		4
D. Listening	X	X	X	X	X	X		X	X	X	X	X	X	X	X	X	X	X		4
E. Speaking	X	X	X	X	X	X		X	X	X	X	X	X	X	X	X	X	X		4
(TS) THINKING SKILLS:																				
A. Creative thinking	X		X									X	X	X	X					3
B. Decision making	X	X	X	X	X	X		X	X	X	X	X	X	X	X	X	X	X		3
C. Problem solving	X	X	X	X	X	X		X	X	X	X	X	X	X	X	X	X	X		3
D. Seeing things in the mind's eye	X	X	X	X	X	X		X	X	X	X	X	X	X	X	X	X	X		4
E. Knowing how to learn	X	X	X	X	X	X		X	X	X	X	X	X	X	X	X	X	X		4
F. Reasoning			X	X					X		X	X	X	X	X	X	X	X		3
(PQ) PERSONAL QUALITIES:																				
A. Responsibility																				
B. Self-esteem																				
C. Social																				
D. Self-management																				
E. Integrity/honesty																				

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SCANS
COMPETENCIES AND FOUNDATION SKILLS
EXIT LEVEL PROFICIENCY MATRIX

The Secretary's Commission on Achieving Necessary Skills (SCANS), U. S. Department of Labor, has identified in its "AMERICA 2000 REPORT' the following five competencies and a three-part foundation of skills and personal qualities that are needed for solid job performance:

COMPETENCIES:

Resources:	Identifies, organizes, plans, and allocates resources
Interpersonal:	Works with others
Information:	Acquires and uses information
Systems:	Understands complex inter-relationships
Technology:	Works with a variety of technologies

FOUNDATION SKILLS:

Basic Skills:	Reads, writes, performs arithmetic and mathematical operations, listens and speaks
Thinking Skills:	Thinks creatively, makes decisions, solves problems, visualizes, knows how to learn and reasons
Personal Qualities:	Displays responsibility, self-esteem, sociability, self-management, and integrity and honesty.

The following matrix identifies the five exit levels of proficiency that are needed for solid job performance.

EXIT LEVEL OF PROFICIENCY					
SCANS Competencies and Foundation Skills	**1**	**2**	**3**	**4**	**5**
	rarely	routinely with supervision	routinely with limited supervision	routinely without supervision	initiates/ improves/ modifies and supervises others

THE MAST COURSE SYLLABI
"PILOT PROGRAM"

MAST has produced a very unique set of course outlines, driven and validated by industry and encompassing the broad range of technologies covered by the MAST grant. The course outlines also include proposed SCANS activities that will be useful to an instructor in preparing students to enter the workforce of the future.

Included in the following pages are final course outlines developed and refined in the process of piloting the MAST training programs. The outlines include a brief course description; required course materials (e.g., textbook, lab manual, and tools, if available); proposed method of instruction; proposed lecture and lab outlines; and detailed course objectives for both Technical Workplace Competencies and SCANS Competencies.

These outlines were completed and revised during the second year of MAST, following completion of the pilot phase. The outlines are intended to serve as an aide to other instructional designers and faculty in community college programs across the nation.

Included on the following pages are the Course Syllabi for each of the courses which were taught during the pilot program.

*M*achine Tool *A*dvanced *S*kills
*T*echnology Program

MAST

COURSE SYLLABUS

COMPOSITION I

MAST PROGRAM
COURSE SYLLABUS
COMPOSITION I

Lecture hours/week: 3 **Lab hours/week: 0** **Credit hours: 3**

COURSE DESCRIPTION:

Designed to teach clear and effective writing, with emphasis on organizational patterns, style, the research paper, and types of composition. The purpose of this course is to help students learn how to use writing to discover and clarify what they think, feel, or believe; to effectively communicate to others in expository and argumentative prose what they think, feel, or believe; to develop critical thinking skills of observation, analysis, synthesis, and evaluation; and to develop a coherent essay within a limited time frame.

PREREQUISITES: **NONE**

COURSE OBJECTIVES:

After the successful completion of this course the student will be able to:

1. To develop proficiency in using the essential steps in the writing process, the student will learn how to:
    a. analyze the basic variables in any writing situation: audience, occasion, purpose, content, form and style
    b. use a variety of pre-writing techniques to gather, generate, and organize ideas
    c. choose effective patterns of organization and development for a specific purpose, occasion, and audience
    d. write effective thesis statements, introductions, conclusions, and transitions
    e. use specific and concrete details to develop paragraphs that are unified, coherent, and complete
    f. revise drafts of an essay by rereading, redefining, and rewriting
    g. edit drafts of an essay to improve sentence style an diction and to eliminate errors in grammar and usage
    h. proofread the final draft of an essay to eliminate typographical, spelling, mechanical, and punctuation errors
2. To develop proficiency in critically evaluating the writing of others, both student and professional, students will learn how to:
    a. identify the thesis, its support, and its development in the work of another writer
    b. describe the audience, occasion, and purpose in a piece of writing
    c. evaluate the effectiveness of the structure, content, and style of an essay and make recommendations for improvement if needed
    d. identify any weaknesses in grammar, usage, and mechanics that interfere with the communication of ideas and suggest improvements
3. To develop proficiency in using the basic tools of scholarship, the student will learn how to:

a. locate information in the library by using the Public Access Catalogue, a variety of computerized and printed indexes, and other research tools
b. evaluate the effectiveness of research information as support for the thesis of an expository or argumentative essay
c. take accurate notes from a source
d. write an accurate paraphrase or precis of others' words and ideas
e. work direct quotations, precis, and paraphrase accurately and coherently into one's own writing
f. document the use of other's words and ideas by using text notes and work cited entries based on the ML format

REQUIRED COURSE MATERIALS:

Textbook: Essays From Contemporary Culture, by Katherine Anne Ackley
Simon and Shuster Handbook for Writers, by Lynn Quitman Troyka
College-level Dictionary

Supplies:

1. One 3.5 hard disk
2. A 100 page 8 ½ x 11 spiral notebook

METHODS OF INSTRUCTION:

Lecture: Didactic presentations will include lectures and instructor demonstrations.

Method of Evaluation: A student's grade will be based on multiple measures of performance. The assessment will measure development of independent critical thinking skills and will include evaluation of the student's ability to:

1. perform the manipulative skills of the craft as required to satisfactorily complete assignments
2. apply theory to assignments
3. perform on written, oral, or practical examinations
4. perform on outside assignments, including writing assignments
5. contribute to class discussions
6. maintain attendance per current policy
7. follow all rules and safety regulations as stated in the manual

LECTURE OUTLINE:

Lecture Topics	Text Reference Page	Contact Hrs.
Course Orientation		
Writing Questionnaire	Handbook Chapter 1	
Creating Exercises for Writing Autobiography	Handbook: Chapter 13	
First Draft of Writing Autobiography Due	Handbook: Chapter 14	
Introduction to Word Processing	Handbook: Chapter 2	
Introduction to Word Processing	Handbook: Chapter 3	

Revising the Writing Autobiography	Handbook: Chapter 11
Final Copy of Writing Autobiography Due	Handbook: Chapter 24
Conferences	
Conferences	
Conferences	
Reading Assignment	Handbook: Chapter 9
Reading Assignment	Handbook: Chapter 10
Reading Assignment	Handbook: Chapter 17
Reading Assignment	Handbook: Chapter 15, Section a
Reading Assignment	Handbook: Chapter 25
Creating Exercises for Personal Narrative	
First Draft of Personal Narrative Due	
Revising Personal Narrative Essay	
Final Copy of Personal Narrative Essay Due	
Conferences	
Conferences	
Conferences	
Reading Assignment	Handbook: Chapter 4, Section a-b
Reading Assignment	Handbook: Chapter 4, Section g
Reading Assignment	Handbook: Chapter 16
Reading Assignment	Handbook: Chapter 15, Sections b-c
Reading Assignment	Handbook: Chapter 18
First Draft of Interpersonal Relationship Essay Due	Handbook: Chapter 16
Revising Interpersonal Relationship Essay	
Final Copy of Interpersonal Relationship Essay Due	Handbook: Chapter 5
Debate Essay	Handout: Debate
Debate Essay	Handout: Debate
Debate Essay	Handout: Debate
First Draft of Essay Due	Handbook: Chapter 31
Revising the Debate Essay	
Final Copy of Debate Essay Due	Handbook: Chapter 32
Research: Library	
Research Paper Due	Handbook: Chapter 33, Sections a-d Handbook: Chapter 34
First Draft of Research Paper Due	
Revising Research Paper	
Final Copy of Research Paper Due	
Final Exam	

Total Lecture Hours ___

COURSE OBJECTIVES: SCANS COMPETENCIES

The Secretary's Commission on Achieving Necessary Skills (SCANS), U. S. Department of Labor, has identified in its "AMERICA 2000 REPORT" that all students should develop a new set of competencies and foundation skills if they are to enjoy a productive, full and satisfying life. These are in addition to the Technical Workplace Competencies required by industry. SCANS is made up of five competencies and a three-part foundation of skills and personal qualities that are needed for solid job performance.

The following activities will be performed by each student for successful completion of this course:

I. COMPETENCIES

A. ***Resources:*** *Identifies, organizes, plans, and allocates resources*
   1. follows a schedule to complete assigned tasks on time
   2. assesses academic progress, enters grades on a progress sheet, evaluates individual performance, and distributes work accordingly, providing feedback to the instructor

B. ***Interpersonal:*** *Works with others*
   1. participate in group activities to review essays, anticipate questions for examinations, and participate in study groups
   2. participate as a "group leader" to coordinate and facilitate activities such as problem solving, individual participation, and provide feedback to the instructor
   3. work well with others from diverse backgrounds, including gender, ethnicity, race, and career goals diversities

C. ***Information:*** *Acquires and uses information*
   1. perform critical analysis exercises and communicate in both oral and written form to classmates and instructors
   2. prepare critical essays
   3. interprets essays and communicates individual interpretations to the class in both written and oral form
   4. prepare essays and papers on the computer using appropriate software applications

D. ***Systems:*** *Understands complex inter-relationships*
   1. understand systems; comprehends categorical organizational systems such as library classification of books, advertisements, and how writers use classification to organize ideas

E. ***Technology:*** *Works with a variety of technologies*
   1. select technology; selects appropriate software applications
   2. applies technology to tasks; uses computer software applications and tutorial programs

II. FOUNDATION SKILLS

A. ***Basic Skills:*** *Reads, writes, performs arithmetic and mathematical operations, listens and speaks.*

1. *Reading: Locates, understands, and interprets written information in prose and in documents such as manuals, graphs, and schedules*
    a. reading assignments are interpreted by individual students and in groups
    b. students locate written passages which illustrate specific ideas
    c. students interpret different styles of writing
2. *Writing: Communicates thoughts, ideas, information, and messages in writing and creates documents such as letters, directions, manuals, reports, graphs, and flow charts*
    a. students are required to write critical essays
    b. students are required to write critical analysis of writings
3. *Listening: Receives, attends to, interprets, and responds to verbal messages and other cues*
    a. listens to individual interpretations of essays and responds within the group to expressed interpretation
4. *Speaking: Organizes ideas and communicates orally*
    a. participates in classroom discussions
    b. organize ideas and communicate specific questions to the instructor
    c. verbally affirms understanding of a concept, procedure, or required skill

B. *Thinking Skills: Thinks creatively, makes decisions, solves problems, visualizes, knows how to learn and reasons.*

1. *Creative Thinking: Generates new ideas*
    a. able to respond to diverse interpretations
    b. identifies actions required to accomplish personal goals
2. *Decision Making: Specifies goals and constraints, generates alternatives, considers risks, and evaluates and chooses best alternative*
    a. evaluates performance and selects appropriate actions
    b. identifies personal goals
3. *Problem Solving: Recognizes problems and devises and implements plan of action*
    a. makes daily accommodations to stay on schedule
    b. seeks additional instruction and clarification for assignment completion
    c. balances social and academic life and responsibilities
    d. accepts responsibility
    e. evaluates grammar, sentence structure, body of paper, etc., and takes appropriate actions
4. *Seeing Things In the Mind's Eye: Organizes, and processes symbols, pictures, graphs, objects, and other information*
    a. understands both written and verbal instructions
5. *Knowing How to Learn: Use efficient learning techniques to acquire and apply new knowledge and skills*
    a. learns to anticipate examination questions, categorize, describe, and explain efficient learning techniques
    b. uses these sequential skills to support mastery of new skills
6. *Reasoning: Discovers a rule or principle underlying the relationship between two or more objects and applies it when solving a problem*

        a. applies rules of word choice in composing essays

C. ***Personal Qualities:** Displays responsibility, self-esteem, sociability, self-management, and integrity and honesty.*

- *1.* ***Responsibility:** Exerts a high level of effort and perseveres toward goal attainment*
    - a. develops an understanding that in order to be successful you must be a "good" student
    - b. develops an understanding that a "good" student is the one who is prompt to every class and has prepared for the day's work
    - c. develops an understanding good students know what they are going to do in class and does not waste time
    - d. develops a fine work ethic
- *2.* ***Self-Esteem:** Believes in own self-worth and maintains a positive view of self*
    - a. learns to take pride in his or her work through positive reinforcement
    - b. sees himself or herself as an asset to the class through continued contributions to the group and a shared common goal
    - c. understands that an individual with a positive attitude and the belief in their own abilities will systematically seek solutions and be a valuable employee
- *3.* ***Sociability:** Demonstrates understanding, friendliness, adaptability, empathy, and politeness in group settings*
    - a. assist classmates in improving technical skills
    - b. assist students with special needs as a peer mentor
    - c. discusses and demonstrates strategies for effective communication across cultures
- *4.* ***Self-Management:** Assesses self accurately, sets personal goals, monitors progress, and exhibits self-control*
    - a. assesses self/personal goals and monitors individual progress
    - b. maintain a record of academic achievement (individual grade book)
    - c. performs goal setting activities
- *5.* ***Integrity/Honesty:** Chooses ethical courses of action*
    - a. accepts the responsibility for own actions
    - b. exhibit personal honesty at all times
    - c. accept the challenge of doing your own work in the laboratory, during examinations, and on outside assignments
    - d. understand the consequences of unethical behavior

***M*achine Tool *A*dvanced *S*kills**
***T*echnology Program**

MAST

COURSE SYLLABUS

INTRODUCTION TO COMPUTER GRAPHICS

MAST PROGRAM
COURSE SYLLABUS
INTRODUCTION TO COMPUTER GRAPHICS

Lecture hours/week: 0 **Lab hours/week: 4** **Credit hours: 2**

COURSE DESCRIPTION:

A study of computer graphics hardware and software fundamentals. Development of basic concepts and skills of computer representation of graphical information. An introduction to the basic usage of AutoCAD, Microsoft PowerPoint, Microsoft Word, Harvard Graphics, Autodesk Animator, DOS/WINDOWS overview.

PREREQUISITES: **NONE**

REQUIRED COURSE MATERIALS:

Textbook: None

Supplies:
3.5 High Density diskettes

METHODS OF INSTRUCTION:

Lecture: Didactic presentations will include instructor demonstrations.

Laboratory: Laboratory will be "hands-on" activities.

Method of Evaluation: A student's grade will be based on multiple measures of performance. The assessment will measure development of independent critical thinking skills and will include evaluation of the student's ability to:

1. perform the manipulative skills of the craft as required to satisfactorily complete assignments
2. apply theory to assignments
3. perform on written, oral, or practical examinations
4. perform on outside assignments, including writing assignments
5. contribute to class discussions
6. maintain attendance per current policy
7. follow all rules and safety regulations as stated in the manual

LAB OUTLINE:

Lab Topics	Contact Hrs.
MD-DOS/Windows Overview	4
AutoCAD Release 13 (Windows Version)	12

Microsoft Office-PowerPoint	12
a. PowerPoint	
b. Word	
Autodesk Animator	12
Harvard Graphics	12
Student Project Time	12
Total Lab Hours	**64**

COURSE OBJECTIVES: TECHNICAL COMPETENCIES

After the successful completion of this course the student will be able to:

A. APPLY MATHEMATICAL CONCEPTS
  1. Perform Basic Arithmetic Operations
     a. Add, subtract, multiply and divide real numbers
     b. Add, subtract, multiply and divide fractions
     c. Convert real numbers to fractional equivalents and vice versa
  2. Compute Unit Conversions
     a. Convert English units to metric units and vice versa
  3. Use Cartesian Coordinate System
     a. Plot absolute coordinate data
     b. Plot relative coordinate data
  4. Use Polar Coordinate System
     a. Plot absolute coordinate data
     b. Plot relative coordinate data

B. DEMONSTRATE FUNDAMENTAL DRAFTING SKILLS
  1. Use Drawing Media and Related Drafting Materials
     a. Select drawing media
  2. Identify Drafting Line Styles and Weights (e.g., center, hidden, object, dimension)
     a. Identify line styles
     b. Apply line styles

C. PLAN AND ORGANIZE ACTIVITIES
  1. Determine Scope of Drafting Assignment
     a. Understand completion date
     b. Identify number of drawings involved
     c. Identify assignment requirements
     d. Understand drawing responsibilities
  2. Select Appropriate Drafting Techniques for Drawings
     a. Identify types of drawings required
     b. Identify types of materials needed

D. USE COMPUTER-AIDED DRAFTING SYSTEM
  1. Demonstrate Proper File Management Techniques
     a. Explain file management techniques
     b. Demonstrate file management procedures
     c. Format a floppy disk
  2. Use Directory Structure
     a. Identify directories and sub-directories
     b. Create and delete directories

3. Edit Drawing File
    a. Create new drawing file
    b. Open existing drawing file
4. Use Geometric Objects (e.g. lines, splines, circles,...)
    a. Construct objects
    b. Edit objects
    c. Manipulate objects
5. Use Text for Drawing Annotation
    a. Create text annotation
    b. Edit text
6. Control Object Properties (color, line-type,...)
    a. Determine object property
    b. Modify object property
7. Use Viewing/Display Commands
    a. Demonstrate view commands
8. Understand Procedure to Print/Plot a Drawing
    a. Demonstrate plotting procedures
    b. Determine scaling and layout
    c. Use various printers and plotters

COURSE OBJECTIVES: SCANS COMPETENCIES

The Secretary's Commission on Achieving Necessary Skills (SCANS), U. S. Department of Labor, has identified in its "AMERICA 2000 REPORT" that all students should develop a new set of competencies and foundation skills if they are to enjoy a productive, full and satisfying life. These are in addition to the Technical Workplace Competencies required by industry. SCANS is made up of five competencies and a three-part foundation of skills and personal qualities that are needed for solid job performance.

The following activities will be performed by each student for successful completion of this course:

I. COMPETENCIES

- ***A. Resources:** Identifies, organizes, plans, and allocates resources*
    1. follows a schedule to complete assigned tasks on time
    2. makes efficient use of computer resources such as disk space, file size and directory maintenance
- ***B. Interpersonal:** Works with others*
    1. work well with all members of class
- ***C. Information:** Acquires and uses information*
    1. read and understand computer graphics assignment
    2. organize and apply computer resources
    3. read and interpret computer graphics practices and standards
    4. use computer-aided design program to complete drafting assignment
- ***D. Systems:** Understands complex inter-relationships*
    1. understand computer generation and graphic images

- E. *Technology: Works with a variety of technologies*
  1. chooses graphics application and settings to complete assignment
  2. understand graphics software set-up and customization

II. FOUNDATION SKILLS

- A. *Basic Skills: Reads, writes, performs arithmetic and mathematical operations, listens and speaks.*
  1. ***Reading:*** *Locates, understands, and interprets written information in prose and in documents such as manuals, graphs, and schedules*
     - a. reads and studies handouts and reference manuals
     - b. reads catalogs and reference sources
  2. ***Writing:*** *Communicates thoughts, ideas, information, and messages in writing and creates documents such as letters, directions, manuals, reports, graphs, and flow charts*
     - a. write lecture notes
     - b. submit written responses to assigned questions
     - c. use proper computer/software terminology
  3. ***Arithmetic/Mathematics:*** *Perform basic computations and approaches practical problems by choosing appropriately from a variety of mathematical techniques*
     - a. calculate animation timing
     - b. convert linear measurements from metric to English and English to metric
     - c. scale drawing
     - d. convert fractions to decimals
     - e. measure drawn objects
  4. ***Listening:*** *Receives, attends to, interprets, and responds to verbal messages and other cues*
     - a. assimilate classroom instruction
     - b. interpret and assimilate video instruction
  5. ***Speaking:*** *Organizes ideas and communicates orally*
     - a. participates in classroom discussions
     - b. organize ideas and communicate specific questions to the instructor
     - c. verbally affirms understanding of a concept, procedure, or required skill
- B. *Thinking Skills: Thinks creatively, makes decisions, solves problems, visualizes, knows how to learn and reasons.*
  1. ***Creative Thinking:*** *Generates new ideas*
     - a. create unique graphics, images and presentations
  2. ***Decision Making:*** *Specifies goals and constraints, generates alternatives, considers risks, and evaluates and chooses best alternative*
     - a. consider various arrangements and orientation for graphic displays
     - b. select manner of presentation
     - c. select object viewing orientation
  3. ***Problem Solving:*** *Recognizes problems and devises and implements plan of action*
     - a. answer assigned questions
     - b. select manner of graphics display

4. *Seeing Things In the Mind's Eye: Organizes, and processes symbols, pictures, graphs, objects, and other information*
   a. interpret engineering drawings
   b. interpret technical illustrations and symbols
   c. understand written and oral instructions
5. *Knowing How to Learn: Use efficient learning techniques to acquire and apply new knowledge and skills*
   a. demonstrate mastery of basic skills and techniques
   b. use previously learned skills to support new skills
6. *Reasoning: Discovers a rule or principle underlying the relationship between two or more objects and applies it when solving a problem*
   a. understands that practice is vital to improving the skill of the student
   b. understands that the quality of the product is a function of the time of the operation and the attitude and skill of the student
   c. demonstrates ability to discriminate between positive and negative, and act accordingly

C. *Personal Qualities: Displays responsibility, self-esteem, sociability, self-management, and integrity and honesty.*

1. *Responsibility: Exerts a high level of effort and perseveres toward goal attainment*
   a. develops an understanding that in order to be successful you must be a "good" student
   b. develops an understanding that a "good" student is the one who is prompt to every class and has prepared for the day's work
   c. develops an understanding good students know what they are going to do in class and does not waste time
   d. develops a fine work ethic
2. *Self-Esteem: Believes in own self-worth and maintains a positive view of self*
   a. learns to take pride in his or her work through positive reinforcement
   b. sees himself or herself as an asset to the class through continued contributions to the group and a shared common goal
   c. understands that an individual with a positive attitude and the belief in their own abilities will systematically seek solutions and be a valuable employee
3. *Sociability: Demonstrates understanding, friendliness, adaptability, empathy, and politeness in group settings*
   a. assist classmates in improving technical skills
   b. assist students with special needs as a peer mentor
   c. discusses and demonstrates strategies for effective communication across cultures
4. *Self-Management: Assesses self accurately, sets personal goals, monitors progress, and exhibits self-control*
   a. assesses self/personal goals and monitors individual progress
   b. maintain a record of academic achievement (individual grade book)
   c. performs goal setting activities

5. *Integrity/Honesty: Chooses ethical courses of action*
   a. accepts the responsibility for own actions
   b. exhibit personal honesty at all times
   c. accept the challenge of doing your own work in the laboratory, during examinations, and on outside assignments
   d. understand the consequences of unethical behavior

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*M*achine Tool *A*dvanced *S*kills
*T*echnology Program

MAST

COURSE SYLLABUS

INTRODUCTION TO DRAFTING

MAST PROGRAM
COURSE SYLLABUS
INTRODUCTION TO DRAFTING

Lecture hours/week: 3 **Lab hours/week: 4** **Credit hours: 4**

COURSE DESCRIPTION:

The theory, technical skills, industrial applications, and practices of basic drafting techniques and methodology are discussed. Topics include technical sketching, geometric construction, orthographic projection, dimensioning, section views, auxiliary views, and fasteners. The course will also introduce the student to basic computer-aided drawing.

PREREQUISITES: **NONE**

REQUIRED COURSE MATERIALS:

Textbook: Technical Drawing, Goetsch, D.L., Nelson, J.A., Chalk, W.D., 3rd Edition, Delmar Publishers, 1994
Workbook for Technical Drawing, Goetsch, D.L., Nelson, J.A., Chalk, W.D., 3rd Edition, Delmar Publishers, 1994

Supplies:
3.5 High Density diskettes

METHODS OF INSTRUCTION:

Lecture: Didactic presentations will include lectures and instructor demonstrations.

Laboratory: Laboratory will be "hands-on" activities.

Method of Evaluation: A student's grade will be based on multiple measures of performance. The assessment will measure development of independent critical thinking skills and will include evaluation of the student's ability to:

1. perform the manipulative skills of the craft as required to satisfactorily complete assignments
2. apply theory to assignments
3. perform on written, oral, or practical examinations
4. perform on outside assignments, including writing assignments
5. contribute to class discussions
6. maintain attendance per current policy
7. follow all rules and safety regulations as stated in the manual

LECTURE OUTLINE

Lecture Topics	Text Reference Page	Contact Hrs.
Introduction; begin CAD		3
Sketching; lettering; more CAD		3
Scales; more CAD		3
Geometric construction; finish CAD		3
Multi-view orthographic projection		6
Section views		6
Auxiliary views		3
Dimensioning		6
Fasteners		3
Pictorials		3
Final Projects		3
	Total Lecture Hours	**51**

LAB OUTLINE:

Lab Topics	Contact Hrs.
Introduction; begin CAD	4
Sketching; lettering; more CAD	4
Scales; more CAD	4
Geometric construction; finish CAD	4
Multi-view orthographic projection	8
Section views	8
Auxiliary views	4
Dimensioning	8
Fasteners	4
Pictorials	4
Final Projects	12
Total Lab Hours	**64**

COURSE OBJECTIVES: TECHNICAL COMPETENCIES

After the successful completion of this course the student will be able to:

A. **APPLY MATHEMATICAL CONCEPTS**
  1. Perform Basic Arithmetic Operations
    a. Add, subtract, multiply and divide real numbers
    b. Add, subtract, multiply and divide fractions
    c. Convert real numbers to fractional equivalents and vice versa
  2. Compute Unit Conversions
    a. Convert English units to metric units and vice versa
    b. Calculate unit conversion ratios
  3. Use Cartesian Coordinate System
    a. Plot absolute coordinate data
    b. Plot relative coordinate data
  4. Use Polar Coordinate System
    a. Plot absolute coordinate data

        - b. Plot relative coordinate data

B. DEMONSTRATE FUNDAMENTAL DRAFTING SKILLS

- 1. Use Drawing Media and Related Drafting Materials
    - a. Select drawing media
    - b. Select related drafting materials (e.g. pencil, triangles, lead,...)
- 2. Use Measuring Scales
    - a. Identify types of scales
    - b. Select appropriate scale
    - c. Use scales to measure and transfer dimensions
- 3. Identify Drafting Line Styles and Weights (e.g., center, hidden, object, dimension)
    - a. Identify line styles
    - b. Apply line styles
- 4. Prepare Title Blocks and Other Drafting Forms
    - a. Identify and prepare title block
- 5. Create Technical Sketches
    - a. Identify and create orthographic drawings (single and multi-view)
    - b. Identify and create axonometric drawings (iso-, tri- and dimetric)
    - c. Identify and create perspective drawings (1, 2 and 3-point)
    - d. Understand and apply techniques of sketching

C. PLAN AND ORGANIZE ACTIVITIES

- 1. Determine Scope of Drafting Assignment
    - a. Understand completion date
    - b. Identify number of drawings involved
    - c. Identify assignment requirements
    - d. Understand drawing responsibilities
- 2. Select Appropriate Drafting Techniques for Drawings
    - a. Identify types of drawings required
    - b. Identify types of materials needed

D. PREPARE MECHANICAL PRODUCTION DRAWINGS

- 1. Understand and Apply Mechanical Drawing Methods
    - a. Understand and apply multi-view orthographic projection
    - b. Understand and apply section views
    - c. Understand and apply auxiliary views
- 2. Perform Technical Lettering
    - a. Understand technical lettering styles
    - b. Identify and apply technical lettering styles
    - c. Identify and apply standard notations
- 3. Apply Dimensions and Notes
    - a. Identify dimensioning systems
    - b. Understand and apply current dimensioning standards
    - c. Understand dimensioning terminology
- 4. Apply Current Drafting Standards to Drawings
    - a. Understand relevant standards
    - b. Identify sources of standards
    - c. Reference standards
    - d. Apply relevant standards
- 5. Use Commercial and Vendor Data
    - a. Understand commercial supplier catalogs

        - b. Understand vendor drawings

E. ASSIST ENGINEERING PERSONNEL

- 1. Utilize Fasteners (e.g. screws, bolts, nuts, seals, springs,...) for Mechanical Applications
    - a. Select appropriate fasteners and springs for application
    - b. Understand basic fastener and spring analysis
    - c. Identify types of fasteners and springs
    - d. Use supplier catalogs and standard references to select fasteners and springs for mechanical application

F. USE COMPUTER-AIDED DRAFTING SYSTEM

- 1. Start and exit a software program
    - a. Understand starting procedures
    - b. Understand exiting procedures
- 2. Demonstrate Proper File Management Techniques
    - a. Explain file management techniques
    - b. Demonstrate file management procedures
    - c. Format a floppy disk
- 3. Use Directory Structure
    - a. Identify directories and sub-directories
    - b. Create and delete directories
- 4. Edit Drawing File
    - a. Create new drawing file
    - b. Open existing drawing file
- 5. Utilize Drawing Set-Up Procedures
    - a. Identify drawing set-up parameters
    - b. Perform drawing set-up
- 6. Use Geometric Objects (e.g. lines, splines, circles,...)
    - a. Construct objects
    - b. Edit objects
    - c. Manipulate objects
- 7. Use Text for Drawing Annotation
    - a. Create text annotation
    - b. Edit text
- 8. Control Object Properties (color, line-type,...)
    - a. Determine object property
    - b. Modify object property
- 9. Use Viewing/Display Commands
    - a. Demonstrate view commands
- 10. Understand Procedure to Print/Plot a Drawing
    - a. Demonstrate plotting procedures
    - b. Determine scaling and layout
    - c. Use various printers and plotters
- 11. Use Standard Layering Techniques
    - a. Define standard layering procedures
    - b. Apply standard layering techniques
- 12. Create Mechanical CAD Drawings
    - a. Use CAD to create multi-view orthographic drawings
    - b. Understand 2-D multi-view drawing procedures on CAD system

13. Use CAD Dimensioning Features
    a. Identify dimensioning variables
    b. Set dimensioning variables
    c. Use dimension drawings using CAD
    d. Use dimensioning standards with CAD
    e. Modify CAD dimensions

COURSE OBJECTIVES: SCANS COMPETENCIES

The Secretary's Commission on Achieving Necessary Skills (SCANS), U. S. Department of Labor, has identified in its "AMERICA 2000 REPORT" that all students should develop a new set of competencies and foundation skills if they are to enjoy a productive, full and satisfying life. These are in addition to the Technical Workplace Competencies required by industry. SCANS is made up of five competencies and a three-part foundation of skills and personal qualities that are needed for solid job performance.

The following activities will be performed by each student for successful completion of this course:

I. **COMPETENCIES**
    A. ***Resources:*** *Identifies, organizes, plans, and allocates resources*
        1. follows a schedule to complete assigned tasks on time
        2. makes efficient use of drafting and CAD resources such as paper, lead, disk space, etc.
    B. ***Interpersonal:*** *Works with others*
        1. work well with all members of class
    C. ***Information:*** *Acquires and uses information*
        1. read and understand drafting assignment
        2. organize and apply drafting resources
        3. read and interpret drafting practices and standards
        4. use computer-aided design program to complete drafting assignment
    D. ***Systems:*** *Understands complex inter-relationships*
        1. understand the engineering design drafting system of drawing and designing
    E. ***Technology:*** *Works with a variety of technologies*
        1. chooses CAD application and settings to complete drafting assignment
        2. understand CAD set-up and customization

II. **FOUNDATION SKILLS**
    A. ***Basic Skills:*** *Reads, writes, performs arithmetic and mathematical operations, listens and speaks.*
        1. ***Reading:*** *Locates, understands, and interprets written information in prose and in documents such as manuals, graphs, and schedules*
            a. reads and studies textbook
            b. reads catalogs and reference sources

2. *Writing: Communicates thoughts, ideas, information, and messages in writing and creates documents such as letters, directions, manuals, reports, graphs, and flow charts*
    a. write lecture notes
    b. submit written responses to assigned questions
    c. use proper engineering drafting terminology
3. *Arithmetic/Mathematics: Perform basic computations and approaches practical problems by choosing appropriately from a variety of mathematical techniques*
    a. calculate proper drawing spacing
    b. convert linear measurements from metric to English and English to metric
    c. scale drawing
    d. convert fractions to decimals
    e. measure drawn objects
4. *Listening: Receives, attends to, interprets, and responds to verbal messages and other cues*
    a. assimilate classroom instruction
    b. interpret and assimilate video instruction
5. *Speaking: Organizes ideas and communicates orally*
    a. participates in classroom discussions
    b. organize ideas and communicate specific questions to the instructor

B. *Thinking Skills: Thinks creatively, makes decisions, solves problems, visualizes, knows how to learn and reasons.*
1. *Decision Making: Specifies goals and constraints, generates alternatives, considers risks, and evaluates and chooses best alternative*
    a. consider various arrangements and orientation for drawings
    b. select drafting technique
    c. select object viewing orientation
    d. select dimensioning layout
2. *Problem Solving: Recognizes problems and devises and implements plan of action*
    a. answer assigned questions
    b. select types of view to describe object
3. *Seeing Things In the Mind's Eye: Organizes, and processes symbols, pictures, graphs, objects, and other information*
    a. interpret engineering drawings
    b. interpret technical illustrations and symbols
    c. understand written and oral instructions
4. *Knowing How to Learn: Use efficient learning techniques to acquire and apply new knowledge and skills*
    a. demonstrate mastery of basic skills and techniques
    b. use previously learned skills to support new skills
5. *Reasoning: Discovers a rule or principle underlying the relationship between two or more objects and applies it when solving a problem*
    a. understands that practice is vital to improving the skill of the student

  - b. understands that the quality of the product is a function of the time of the operation and the attitude and skill of the student
  - c. demonstrates ability to discriminate between positive and negative, and act accordingly

C. *Personal Qualities: Displays responsibility, self-esteem, sociability, self-management, and integrity and honesty.*

1. *Responsibility: Exerts a high level of effort and perseveres toward goal attainment*
   - a. develops an understanding that in order to be successful you must be a "good" student
   - b. develops an understanding that a "good" student is the one who is prompt to every class and has prepared for the day's work
   - c. develops an understanding good students know what they are going to do in class and does not waste time
   - d. develops a fine work ethic
2. *Self-Esteem: Believes in own self-worth and maintains a positive view of self*
   - a. learns to take pride in his or her work through positive reinforcement
   - b. sees himself or herself as an asset to the class through continued contributions to the group and a shared common goal
   - c. understands that an individual with a positive attitude and the belief in their own abilities will systematically seek solutions and be a valuable employee
3. *Sociability: Demonstrates understanding, friendliness, adaptability, empathy, and politeness in group settings*
   - a. assist classmates in improving technical skills
   - b. assist students with special needs as a peer mentor
   - c. discusses and demonstrates strategies for effective communication across cultures
4. *Self-Management: Assesses self accurately, sets personal goals, monitors progress, and exhibits self-control*
   - a. assesses self/personal goals and monitors individual progress
   - b. maintain a record of academic achievement (individual grade book)
   - c. performs goal setting activities
5. *Integrity/Honesty: Chooses ethical courses of action*
   - a. accepts the responsibility for own actions
   - b. exhibit personal honesty at all times
   - c. accept the challenge of doing your own work in the laboratory, during examinations, and on outside assignments
   - d. understand the consequences of unethical behavior

*M*achine Tool *A*dvanced *S*kills
*T*echnology Program

MAST

COURSE SYLLABUS

TECHNICAL MATHEMATICS

MAST PROGRAM
COURSE SYLLABUS
TECHNICAL MATHEMATICS

Lecture hours/week: 5 **Lab hours/week: 0** **Credit hours: 5**

COURSE DESCRIPTION:

Topics in algebra with physical applications. Recommended for students in the electronics, non-destructive evaluation and mechanical design programs.

PREREQUISITES: **Beginning Algebra with Geometry or 2 years high school math (grade of C or better)**

REQUIRED COURSE MATERIALS:

Textbook: Technical Mathematics, by John C. Peterson, 1994

Supplies: None

METHODS OF INSTRUCTION:

Lecture: Didactic presentations will include lectures and instructor demonstrations.

Method of Evaluation: A student's grade will be based on multiple measures of performance. The assessment will measure development of independent critical thinking skills and will include evaluation of the student's ability to:

1. perform the manipulative skills of the craft as required to satisfactorily complete assignments
2. apply theory to assignments
3. perform on written, oral, or practical examinations
4. perform on outside assignments, including writing assignments
5. contribute to class discussions
6. maintain attendance per current policy
7. follow all rules and safety regulations as stated in the manual

LECTURE OUTLINE

Lecture Topics	Text Reference Page	Contact Hrs.
Real Number Systems: Sets, Exponents, Measurement, Scientific Notation, Roots and Radicals		10
Algebraic Concepts: Simplifying Expressions, First-Degree Equations, and Word Problems		10

Geometric Applications: Areas, Perimeters and Volume	5
Rectangular Coordinate System: Relations, Functions, and Functional Notation and Graphs	10
Systems of Equations: Matrices, Determinants, Cramer's Rule and World Problems	10
Similar Figures: Variation - Direct, Inverse and Joint	10
Factoring: Linear, Quadratic and Cubic	10
Fractional Equations and Extraneous Roots, Quadratic Equations and Quadratic Formula	10
Logarithm Function: Basic Properties and Principles, Inverse of Power Function	5
Imaginary and Complex Numbers	5
Total Lecture Hours	**85**

COURSE OBJECTIVES: TECHNICAL COMPETENCIES

After the successful completion of this course the student will be able to:

A. APPLY MATHEMATICAL CONCEPTS

1. Perform Basic Arithmetic Operations
   a. Add, subtract, multiply and divide real numbers
   b. Add, subtract, multiply and divide fractions
   c. Convert real numbers to fractional equivalents and vice versa
2. Compute Unit Conversions
   a. Convert English units to metric units and vice versa
3. Perform Basic Trigonometric Operations
   a. Use trigonometric functions to calculate angles
   b. Use trigonometric functions to calculate linear distances
4. Use Cartesian Coordinate System
   a. Plot absolute coordinate data
   b. Plot relative coordinate data
5. Use Polar Coordinate System
   a. Plot absolute coordinate data
   b. Plot relative coordinate data

B. USE COMPUTER-AIDED DRAFTING SYSTEM

1. Start and exit a software program
   a. Understand starting procedures
   b. Understand exiting procedures

COURSE OBJECTIVES: SCANS COMPETENCIES

The Secretary's Commission on Achieving Necessary Skills (SCANS), U. S. Department of Labor, has identified in its "AMERICA 2000 REPORT" that all students should develop a new set of competencies and foundation skills if they are to enjoy a productive, full and satisfying life. These are in addition to the Technical Workplace Competencies required by industry. SCANS is made up of five competencies and a three-part foundation of skills and personal qualities that are needed for solid job performance.

The following activities will be performed by each student for successful completion of this course:

I. COMPETENCIES

- A. ***Resources:** Identifies, organizes, plans, and allocates resources*
  1. follows a schedule to complete assigned tasks on time
  2. provide a self-evaluation of performance based on the time and quality of work
  3. assesses own skills to determine when to get extra help or use the math lab with videos, computers, tutorials, etc.
- B. ***Interpersonal:** Works with others*
  1. participates in classroom dialogue, contributing to group effort in problem solving
  2. work well with all members of class
  3. communicates ideas on take-home exams to justify answers
- C. ***Information:** Acquires and uses information*
  1. apply mathematical solutions to problems assigned
  2. organize and maintain lecture notebook and assignment notebook
  3. communicates and interprets information by participating in classroom dialogue
  4. acquires math material from the text, videos, and computers
  5. interprets information in problem solving situations on homework, lab worksheets, and exams
- D. ***Systems:** Understands complex inter-relationships*
  1. understand systems:
     - a. applies a systematic approach to solving mathematical problems
     - b. develops an understanding of mathematical system complexity with applications to algebra, geometry, and trigonometric equation solving
     - c. operates within the organizational system of the class procedures to fulfill the requirements to pass the course
     - d. monitors own progress in the class and understanding of math concepts to know when to seek additional help

II. FOUNDATION SKILLS

- A. ***Basic Skills:** Reads, writes, performs arithmetic and mathematical operations, listens and speaks.*

1. *Reading: Locates, understands, and interprets written information in prose and in documents such as manuals, graphs, and schedules*
    - a. interprets word problems, tables, graphs, and drawings to identify presented problem(s)
    - b. reads and studies textbook, available tutorials, and video tapes
    - c. uses available tutorials in the laboratory as needed
2. *Writing: Communicates thoughts, ideas, information, and messages in writing and creates documents such as letters, directions, manuals, reports, graphs, and flow charts*
    - a. communicates problem solving skills by solving mathematical problems in writing using presented information
    - b. maintains a lecture notebook
    - c. completes all written assignments
    - d. completes examinations, including definitions, problem solving, and concept explanations
    - e. submits written responses to chapter question assignments
3. *Arithmetic/Mathematics: Perform basic computations and approaches practical problems by choosing appropriately from a variety of mathematical techniques*
    - a. adds, subtracts, multiplies, and divides all numbers in the complex number system, algebraic expressions, equations, and functions
    - b. analyzes and graphs functions and equations
    - c. solves application problems using algebraic, analytic, and geometric techniques
    - d. solves equations algebraically and geometrically
    - e. identifies functions and their graphs
4. *Listening: Receives, attends to, interprets, and responds to verbal messages and other cues*
    - a. listens to lectures and takes notes
    - b. listens to instructions for homework, laboratory, and examination assignments
    - c. listens to questions and responses of students participating in class discussions
    - d. interpret and assimilate video instruction
5. *Speaking: Organizes ideas and communicates orally*
    - a. participates in classroom discussions
    - b. organize ideas and communicate specific questions to the instructor

B. Thinking Skills: Thinks creatively, makes decisions, solves problems, visualizes, knows how to learn and reasons.

1. *Creative Thinking: Generates new ideas*
    - a. develops new ideas for approaching problem solving
2. *Decision Making: Specifies goals and constraints, generates alternatives, considers risks, and evaluates and chooses best alternative*
    - a. selects specific math applications
    - b. selects approach necessary to solve math problems
3. *Problem Solving: Recognizes problems and devises and implements plan of action*

    - a. solves mathematical problems using an organized step-by-step approach
  - 4. ***Seeing Things In the Mind's Eye:*** *Organizes, and processes symbols, pictures, graphs, objects, and other information*
    - a. prepares sketches, graphs, and tables to assist in understanding word problems
    - b. interprets word problems
    - c. assimilates arithmetic problems in class
    - d. interprets non-verbal communication in the classroom
    - e. understands both written and verbal instructions
  - 5. ***Knowing How to Learn:*** *Use efficient learning techniques to acquire and apply new knowledge and skills*
    - a. recognizes relevant information to solve specific problem(s)
    - b. identifies "given" data and applies appropriate equations
    - c. demonstrates mastery of basic math skills
    - d. uses sequential math skills to support mastery of new skills
    - e. thinks through the problem mentally before selecting appropriate formula(e) and equation(s)
    - f. uses previously acquired knowledge to assist in learning new concepts
  - 6. ***Reasoning:*** *Discovers a rule or principle underlying the relationship between two or more objects and applies it when solving a problem*
    - a. selects appropriate mathematical application after considering all given data
    - b. understands and applies the concepts and applications of theorems and algebraic rules
    - c. builds functions and equations describing the relationship between two or more quantities
- C. ***Personal Qualities:*** *Displays responsibility, self-esteem, sociability, self-management, and integrity and honesty.*
  - 1. ***Responsibility:*** *Exerts a high level of effort and perseveres toward goal attainment*
    - a. develops an understanding that in order to be successful you must be a "good" student
    - b. develops an understanding that a "good" student is the one who is prompt to every class and has prepared for the day's work
    - c. develops an understanding good students know what they are going to do in class and does not waste time
    - d. develops a fine work ethic
  - 2. ***Self-Esteem:*** *Believes in own self-worth and maintains a positive view of self*
    - a. learns to value individual math abilities through positive reinforcement
    - b. accepts shared common goals of the class and views each individual as an asset to the group
  - 3. ***Sociability:*** *Demonstrates understanding, friendliness, adaptability, empathy, and politeness in group settings*
    - a. assist classmates in improving mathematical skills

    b. shares laboratory facilities
    c. assists classmates in understanding math applications in a group
4. ***Self-Management:** Assesses self accurately, sets personal goals, monitors progress, and exhibits self-control*
    a. maintain a record of academic achievement (individual grade book)
    b. accept the responsibility for self-management
    c. set goals and complete assigned tasks
5. ***Integrity/Honesty:** Chooses ethical courses of action*
    a. accepts the responsibility for own actions
    b. exhibit honesty at all times
    c. accept the responsibility of doing your own work in the laboratory, during examinations, and on outside assignments
    d. understand the consequences of unethical behavior

Machine Tool ***A***dvanced ***S***kills
Technology Program

MAST

COURSE SYLLABUS

INTRODUCTION TO MACHINE TOOLS

MAST PROGRAM
COURSE SYLLABUS
INTRODUCTION TO MACHINE TOOLS

Lecture hours/week: 2 **Lab hours/week: 2** **Credit hours: 4**

COURSE DESCRIPTION:

A general introduction to machining as a foundation technology in manufacturing. Introduction to the theory and operation of drilling, milling, and turning machines. Determining speeds and feeds and making precision measurements.

PREREQUISITES: **NONE**

REQUIRED COURSE MATERIALS:

Textbook: Machine Tool Practices, Kibbe, Neely, and Meyer, Wiley Pub., Latest Edition
Machinery's Handbook, revised by Johnson, Latest Edition

Supplies: The following items are strongly recommended:

1. A six (6) inch 4R graduation satin chrome finish rule
2. A 0-1" micrometer
3. A 6" vernier caliper
4. Safety shoes
5. An Apron
6. Safety glasses
7. Side shields

METHODS OF INSTRUCTION:

Lecture: Didactic presentations will include lectures and instructor demonstrations.

Laboratory: Laboratory will be "hands-on" activities.

Method of Evaluation: A student's grade will be based on multiple measures of performance. The assessment will measure development of independent critical thinking skills and will include evaluation of the student's ability to:

1. perform the manipulative skills of the craft as required to satisfactorily complete assignments
2. apply theory to assignments
3. perform on written, oral, or practical examinations
4. perform on outside assignments, including writing assignments

5. contribute to class discussions
6. maintain attendance per current policy
7. follow all rules and safety regulations as stated in the manual

Schedule: Because of the individualized nature of the Introduction to Machine Tools program, no firm schedule will be followed.

LECTURE OUTLINE:

Lecture Topics	Text Reference Page	Contact Hrs.
Complete measuring exercises using a rule, micrometer and vernier caliper		4
Weld, anneal, and grind a bandsaw blade sample		4
Layout, cut, and file a drill gage according to print		4
Sharpen a drill & drill a test hole within tolerance		2
Perform a drilling and tapping exercise		5
Shape a lathe tool out of mild steel using a pedestal grinder		4
Turn a lathe center according to print		5
Perform a milling profile exercise		4
	Total Lecture Hours	32

LAB OUTLINE:

Lab Topics		Contact Hrs.
Complete measuring exercises using a rule, micrometer and vernier caliper		4
Weld, anneal, and grind a bandsaw blade sample		4
Layout, cut, and file a drill gage according to print		4
Sharpen a drill & drill a test hole within tolerance		2
Perform a drilling and tapping exercise		5
Shape a lathe tool out of mild steel using a pedestal grinder		4
Turn a lathe center according to print		5
Perform a milling profile exercise		4
	Total Lab Hours	32

COURSE OBJECTIVES: TECHNICAL COMPETENCIES

After the successful completion of this course, the student will be able to:

A. APPLY MATHEMATICAL CONCEPTS

1. Perform Basic Arithmetic Operations
    a. Add, subtract, multiply and divide real numbers
    b. Add, subtract, multiply and divide fractions
    c. Convert real numbers to fractional equivalents and vice versa
2. Compute Unit Conversions
    a. Convert English units to metric units and vice versa
    b. Calculate unit conversion ratios
3. Perform Basic Trigonometric Operations
    a. Use trigonometric functions to calculate angles
    b. Use trigonometric functions to calculate linear distances
4. Use Cartesian Coordinate System
    a. Plot absolute coordinate data
    b. Plot relative coordinate data
5. Use Polar Coordinate System
    a. Plot absolute coordinate data
    b. Plot relative coordinate data

B. DEMONSTRATE FUNDAMENTAL DRAFTING SKILLS

1. Use Measuring Scales
    a. Identify types of scales
    b. Select appropriate scale
    c. Use scales to measure and transfer dimensions

C. PREPARE MECHANICAL PRODUCTION DRAWINGS

1. Understand and Apply Mechanical Drawing Methods
    a. Understand and apply multi-view orthographic projection
    b. Understand and apply section views
    c. Understand and apply auxiliary views

D. ASSIST ENGINEERING PERSONNEL

1. Understand Basic Manufacturing Methods
    a. Identify types of manufacturing operation
    b. Understand application of manufacturing in drafting and design of machinery
    c. Prepare drawing for manufacturing application (e.g. casting drawings, forging drawings,...)

COURSE OBJECTIVES: SCANS COMPETENCIES

The Secretary's Commission on Achieving Necessary Skills (SCANS), U. S. Department of Labor, has identified in its "AMERICA 2000 REPORT" that all students should develop a new set of competencies and foundation skills if they are to enjoy a productive, full and satisfying life. These are in addition to the Technical Workplace Competencies required by industry.

SCANS is made up of five competencies and a three-part foundation of skills and personal qualities that are needed for solid job performance.

The following activities will be performed by each student for successful completion of this course:

I. **COMPETENCIES**

- *A.* ***Resources:*** *Identifies, organizes, plans, and allocates resources*
    1. follows a schedule to complete assigned tasks on time
    2. makes efficient use of information resources such as books, manuals, etc.
    3. makes efficient use of material resources
- *B.* ***Interpersonal:*** *Works with others*
    1. work well with all members of class
- *C.* ***Information:*** *Acquires and uses information*
    1. read and understand assignment
    2. organize and apply resources
    3. read and interpret blueprints
    4. organize and apply machine tool operating procedures
- *D.* ***Systems:*** *Understands complex inter-relationships*
    1. demonstrate knowledge of the following systems:
        - a. machine shop organizational structure
        - b. systematic approach to metal-removal process
        - c. dimensioning and measurement systems
    2. monitors and corrects performance during:
        - a. the machining process
        - b. individual work schedule
        - c. evaluation of work results
- *E.* ***Technology:*** *Works with a variety of technologies*
    1. chooses procedure, tools and equipment required to produce a part
    2. aApplies appropriate procedures and uses appropriate tools and equipment
    3. mMaintain and troubleshoots equipment
        - a. applies preventive maintenance
        - b. during machine operation
        - c. cleans machining area after machining

II. **FOUNDATION SKILLS**

- *A.* ***Basic Skills:*** *Reads, writes, performs arithmetic and mathematical operations, listens and speaks.*
    1. ***Reading:*** *Locates, understands, and interprets written information in prose and in documents such as manuals, graphs, and schedules*
        - a. reads and studies textbook and operation manuals
        - b. reads catalogs and reference sources
        - c. reads blueprints and technical drawings
    2. ***Writing:*** *Communicates thoughts, ideas, information, and messages in writing and creates documents such as letters, directions, manuals, reports, graphs, and flow charts*

   - a. write lecture notes
   - b. submit written responses to assigned questions
   - c. use proper machining terminology

3. ***Arithmetic/Mathematics:*** *Perform basic computations and approaches practical problems by choosing appropriately from a variety of mathematical techniques*
   - a. determine proper machining speeds, feeds and depths of cut
   - b. compute machining times
   - c. convert units from English to metric and vice versa
   - d. convert fractions to decimals
   - e. measure objects
   - f. apply trigonometric procedures to machining problems
4. ***Listening:*** *Receives, attends to, interprets, and responds to verbal messages and other cues*
   - a. assimilate classroom instruction
   - b. interpret and assimilate video instruction
5. ***Speaking:*** *Organizes ideas and communicates orally*
   - a. participates in classroom discussions
   - b. organize ideas and communicate specific questions to the instructor

B. ***Thinking Skills:*** *Thinks creatively, makes decisions, solves problems, visualizes, knows how to learn and reasons.*

1. ***Decision Making:*** *Specifies goals and constraints, generates alternatives, considers risks, and evaluates and chooses best alternative*
   - a. consider various arrangements for machining
   - b. select machining process
   - c. select feeds, speeds and depths
2. ***Problem Solving:*** *Recognizes problems and devises and implements plan of action*
   - a. answer assigned questions
   - b. complete machining assignments
3. ***Seeing Things In the Mind's Eye:*** *Organizes, and processes symbols, pictures, graphs, objects, and other information*
   - a. interpret engineering drawings
   - b. interpret technical illustrations and symbols
   - c. understand written and oral instructions
4. ***Knowing How to Learn:*** *Use efficient learning techniques to acquire and apply new knowledge and skills*
   - a. demonstrate mastery of basic skills and techniques
   - b. use previously learned skills to support new skills
5. ***Reasoning:*** *Discovers a rule or principle underlying the relationship between two or more objects and applies it when solving a problem*
   - a. understands relationship between various metals and tools and adjusts machining parameters accordingly

C. ***Personal Qualities:*** *Displays responsibility, self-esteem, sociability, self-management, and integrity and honesty.*

1. ***Responsibility:*** *Exerts a high level of effort and perseveres toward goal attainment*

   a. develops an understanding that in order to be successful you must be a "good" student
   b. develops an understanding that a "good" student is the one who is prompt to every class and has prepared for the day's work
   c. develops an understanding good students know what they are going to do in class and does not waste time
   d. develops a fine work ethic

2. ***Self-Esteem:** Believes in own self-worth and maintains a positive view of self*
   a. learns to take pride in his or her work through positive reinforcement
   b. sees himself or herself as an asset to the class through continued contributions to the group and a shared common goal
   c. understands that an individual with a positive attitude and the belief in their own abilities will systematically seek solutions and be a valuable employee
3. ***Sociability:** Demonstrates understanding, friendliness, adaptability, empathy, and politeness in group settings*
   a. assist classmates in improving technical skills
   b. assist students with special needs as a peer mentor
   c. share laboratory resources (machines, tools and instructor's individual attention)
4. ***Self-Management:** Assesses self accurately, sets personal goals, monitors progress, and exhibits self-control*
   a. perform in-process quality checks on machined parts
   b. maintain a record of academic achievement (individual grade book)
   c. make accommodations to laboratory schedules due to broken machines/tools
   d. accept the responsibility for self-management
5. ***Integrity/Honesty:** Chooses ethical courses of action*
   a. accepts the responsibility for own actions
   b. exhibit personal honesty at all times
   c. accept the challenge of doing your own work in the laboratory, during examinations, and on outside assignments
   d. understand the consequences of unethical behavior

*M*achine Tool *A*dvanced *S*kills
*T*echnology Program

MAST

COURSE SYLLABUS

MECHANICAL DETAILING

MAST PROGRAM
COURSE SYLLABUS
MECHANICAL DETAILING

Lecture hours/week: 2 **Lab hours/week: 3** **Credit hours: 3**

COURSE DESCRIPTION:

The course emphasizes theory, further development of technical skills and industrial applications in casting, forging, stamping, machine drawings, fit specifications, detail and assembly drawings. Full use of computer-aided drafting and design is highly encouraged.

PREREQUISITES: **Introduction to Drafting, Technical Mathematics, Composition I, Introduction to Machine Tools**

REQUIRED COURSE MATERIALS:

Textbook: Engineering Drawing and Design, C. Jensen, J. D. Helsel, Glencoe/McGraw-Hill, 5th Edition, 1996

Supplies:
The assignments in this course require many hours of drafting. However, it is at the discretion of the student whether the drawings are completed manually or using CAD. If the student is drawing manually then there are drafting supplies and equipment which are needed and must be furnished by the student. The only equipment that is supplied by the department is the drafting table (with mechanical drafting arm) and the copying machine. The following is a short list of the minimum items necessary.

- 45°-45°-90° triangle
- 30°-60°-90° triangle
- metric scale
- circle templates
- compass
- mechanical pencil
- Mechanical Engineers scale
- Civil Engineers scale
- drafting leads (ex. 4H, 2H, HB, B, 2B)
- lead sharpener
- eraser
- eraser pad
- eraser shield
- drafting tape
- drafting paper: standard white paper, unlined, (8½" x 11")
- graph paper, ¼" square grid (8½" x 11")
- vellum (11" x 17") (B size) with or without title block

METHODS OF INSTRUCTION:

Lecture: Didactic presentations will include lectures and instructor demonstrations.

Laboratory: Laboratory will be "hands-on" activities.

Method of Evaluation: A student's grade will be based on multiple measures of performance. The assessment will measure development of independent critical thinking skills and will include evaluation of the student's ability to:

1. perform the manipulative skills of the craft as required to satisfactorily complete assignments
2. apply theory to assignments
3. perform on written, oral, or practical examinations
4. perform on outside assignments, including writing assignments
5. contribute to class discussions
6. maintain attendance per current policy
7. follow all rules and safety regulations as stated in the manual

LECTURE OUTLINE

Lecture Topics	Text Reference Page	Contact Hrs.
Introduction; drafting review		2
Drafting review (continued)		2
Fits and allowances		4
Introduction to manufacturing / forming processes		2
Detail drawings		4
Casting drawings		2
Forging drawings		2
Sheet metal drawings		2
Welding drawings		2
Assembly drawings		2
Final Projects		2
	Total Lecture Hours	**49**

LAB OUTLINE

Lab Topics	Contact Hrs.
Introduction; drafting review	3
Drafting review (continued)	3
Fits and allowances	6
Introduction to manufacturing / forming processes	3
Detail drawings	6
Casting drawings	3
Forging drawings	3
Sheet metal drawings	3
Welding drawings	3

Assembly drawings	3
Final Projects	13
Total Lab Hours	**26**

COURSE OBJECTIVES: TECHNICAL COMPETENCIES

After the successful completion of this course the student will be able to:

A. APPLY MATHEMATICAL CONCEPTS
  1. Perform Basic Arithmetic Operations
    a. Add, subtract, multiply and divide real numbers
    b. Add, subtract, multiply and divide fractions
    c. Convert real numbers to fractional equivalents and vice versa
  2. Compute Unit Conversions
    a. Convert English units to metric units and vice versa
    b. Calculate unit conversion ratios
  3. Use Cartesian Coordinate System
    a. Plot absolute coordinate data
    b. Plot relative coordinate data
  4. Use Polar Coordinate System
    a. Plot absolute coordinate data
    b. Plot relative coordinate data

B. DEMONSTRATE FUNDAMENTAL DRAFTING SKILLS
  1. Use Drawing Media and Related Drafting Materials
    a. Select drawing media
    b. Select related drafting materials (e.g. pencil, triangles, lead,...)
  2. Use Measuring Scales
    a. Identify types of scales
    b. Select appropriate scale
    c. Use scales to measure and transfer dimensions
  3. Identify Drafting Line Styles and Weights (e.g., center, hidden, object, dimension)
    a. Identify line styles
    b. Apply line styles
  4. Prepare Title Blocks and Other Drafting Forms
    a. Identify and prepare title block
    b. Identify and prepare bill of material/parts list
    c. Identify and prepare revision history block
    d. Identify and prepare tolerance block
  5. Create Technical Sketches
    a. Identify and create orthographic drawings (single and multi-view)
    b. Identify and create axonometric drawings (iso-, tri- and diametric)

C. PLAN AND ORGANIZE ACTIVITIES
  1. Determine Scope of Drafting Assignment
    a. Understand completion date
    b. Identify number of drawings involved
    c. Identify assignment requirements
    d. Understand drawing responsibilities
  2. Select Appropriate Drafting Techniques for Drawings

    - a. Identify types of drawings required
    - b. Identify types of materials needed
  - 3. Maintain Supporting Documents
    - a. Identify supporting documents involved
    - b. Understand document filing system
    - c. Understand document responsibilities

D. PREPARE MECHANICAL PRODUCTION DRAWINGS

  - 1. Understand and Apply Mechanical Drawing Methods
    - a. Understand and apply multi-view orthographic projection
    - b. Understand and apply section views
    - c. Understand and apply auxiliary views
  - 2. Create Detail Drawings
    - a. Understand and apply detail drawing methods
    - b. Identify types of detail drawings
    - c. Understand layout of detail drawings
    - d. Identify individual parts for detailing
    - e. Understand role of the manufacturing process in the detail drawings
    - f. Identify part dimensions from drawings
  - 3. Create Assembly Drawings
    - a. Identify types of assembly drawings
    - b. Understand and apply appropriate assembly drawing layout
    - c. Understand and apply assembly drawing practices
  - 4. Perform Technical Lettering
    - a. Understand technical lettering styles
    - b. Identify and apply technical lettering styles
    - c. Identify and apply standard notations
  - 5. Create Bill of Material/Parts List
    - a. Identify components included in bill of material/parts list
    - b. Identify commercially available components in assembly
    - c. Identify non-commercially available custom components in assembly
    - d. Understand format of a bill of material/parts list
  - 6. Apply Dimensions and Notes
    - a. Identify dimensioning systems
    - b. Understand and apply current dimensioning standards
    - c. Understand dimensioning terminology
    - d. Understand and apply detail dimensioning practices
    - e. Understand and apply assembly dimensioning practices
  - 7. Apply Dimensional Limits and Tolerances
    - a. Understand tolerancing procedures
    - b. Identify types of tolerances
    - c. Apply tolerances to features
    - d. Compute tolerance ranges
    - e. Understand inch fit system
    - f. Understand metric fit system
    - g. Apply fit specifications to features
    - h. Compute fits from tabular data and vice versa
    - i. Identify types of fits
  - 8. Apply Current Drafting Standards to Drawings

        - a. Understand relevant standards
        - b. Identify sources of standards
        - c. Reference standards
        - d. Apply relevant standards
    - 9. Perform Drawing Revisions
        - a. Understand reason for revisions
        - b. Apply revision notations
        - c. Complete revision documentation
    - 10. Use Commercial and Vendor Data
        - a. Understand commercial supplier catalogs
        - b. Understand vendor drawings

E. ASSIST ENGINEERING PERSONNEL

- 1. Utilize Fasteners (e.g. screws, bolts, nuts, seals, springs,...) for Mechanical Applications
    - a. Select appropriate fasteners and springs for application
    - b. Understand basic fastener and spring analysis
    - c. Identify types of fasteners and springs
    - d. Use supplier catalogs and standard references to select fasteners and springs for mechanical application
- 2. Utilize Power Transmission Elements (e.g. gears, cams, belts, chains,
- 3. Understand Basic Manufacturing Methods
    - a. Identify types of manufacturing operation
    - b. Understand application of manufacturing in drafting and design of machinery
    - c. Prepare drawing for manufacturing application (e.g. casting drawings, forging drawings,...)

F. USE COMPUTER-AIDED DRAFTING SYSTEM

- 1. Demonstrate Proper File Management Techniques
    - a. Explain file management techniques
    - b. Demonstrate file management procedures
    - c. Format a floppy disk
- 2. Use Directory Structure
    - a. Identify directories and sub-directories
    - b. Create and delete directories
- 3. Edit Drawing File
    - a. Create new drawing file
    - b. Open existing drawing file
- 4. Utilize Drawing Set-Up Procedures
    - a. Identify drawing set-up parameters
    - b. Perform drawing set-up
- 5. Use Geometric Objects (e.g. lines, splines, circles,...)
    - a. Construct objects
    - b. Edit objects
    - c. Manipulate objects
- 6. Use Text for Drawing Annotation
    - a. Create text annotation
    - b. Edit text
- 7. Control Object Properties (color, line-type,...)

    a. Determine object property
    b. Modify object property
8. Use Viewing/Display Commands
    a. Demonstrate view commands
9. Use Standard Parts and/or Symbol Libraries
    a. Create parts/symbols
    b. Create symbol libraries
    c. Use standard parts/symbol libraries
10. Understand Procedure to Print/Plot a Drawing
    a. Demonstrate plotting procedures
    b. Determine scaling and layout
    c. Use various printers and plotters
11. Use Standard Layering Techniques
    a. Define standard layering procedures
    b. Apply standard layering techniques
12. Create Mechanical CAD Drawings
    a. Use CAD to create multi-view orthographic drawings
    b. Understand 2-D multi-view drawing procedures on CAD system
13. Use CAD Dimensioning Features
    a. Identify dimensioning variables
    b. Set dimensioning variables
    c. Use dimension drawings using CAD
    d. Use dimensioning standards with CAD
    e. Modify CAD dimensions
14. Use Third-Party Software for CAD Enhancement
    a. Identify third-party software
    b. Use third-party software
15. Perform CAD Customization Procedures
    a. Identify customization techniques and procedures
    b. Use customization techniques and procedures

COURSE OBJECTIVES: SCANS COMPETENCIES

The Secretary's Commission on Achieving Necessary Skills (SCANS), U. S. Department of Labor, has identified in its "AMERICA 2000 REPORT" that all students should develop a new set of competencies and foundation skills if they are to enjoy a productive, full and satisfying life. These are in addition to the Technical Workplace Competencies required by industry. SCANS is made up of five competencies and a three-part foundation of skills and personal qualities that are needed for solid job performance.

The following activities will be performed by each student for successful completion of this course:

I. COMPETENCIES

A. ***Resources:*** *Identifies, organizes, plans, and allocates resources*
    1. follows a schedule to complete assigned tasks on time

2. makes efficient use of drafting resources such as paper, leads, and ink

B. ***Interpersonal: Works with others***

1. work well with all members of class

C. ***Information: Acquires and uses information***

1. read and understand drafting assignment
2. organize and apply drafting resources
3. read and interpret drafting practices and standards
4. use computer-aided design program to complete drafting assignment

D. ***Systems: Understands complex inter-relationships***

1. understand the engineering design drafting system of drawing and designing

E. ***Technology: Works with a variety of technologies***

1. chooses CAD application and settings to complete drafting assignment
2. understand CAD set-up and customization

II. FOUNDATION SKILLS

A. ***Basic Skills:*** *Reads, writes, performs arithmetic and mathematical operations, listens and speaks.*

1. ***Reading:*** *Locates, understands, and interprets written information in prose and in documents such as manuals, graphs, and schedules*

a. reads and studies textbook
b. reads catalogs and reference sources

2. ***Writing:*** *Communicates thoughts, ideas, information, and messages in writing and creates documents such as letters, directions, manuals, reports, graphs, and flow charts*

a. write lecture notes
b. submit written responses to assigned questions
c. use proper engineering drafting terminology

3. ***Arithmetic/Mathematics:*** *Perform basic computations and approaches practical problems by choosing appropriately from a variety of mathematical techniques*

a. calculate proper drawing spacing
b. convert linear measurements from metric to English and English to metric
c. scale drawing
d. convert fractions to decimals
e. measure drawn objects
f. compute proper fit tolerance specifications

4. ***Listening:*** *Receives, attends to, interprets, and responds to verbal messages and other cues*

a. assimilate classroom instruction
b. interpret and assimilate video instruction

5. ***Speaking:*** *Organizes ideas and communicates orally*

a. participates in classroom discussions
b. organize ideas and communicate specific questions to the instructor

B. ***Thinking Skills:*** *Thinks creatively, makes decisions, solves problems, visualizes, knows how to learn and reasons.*

1. ***Decision Making:** Specifies goals and constraints, generates alternatives, considers risks, and evaluates and chooses best alternative*
    a. consider various orientations for drawings
    b. select drafting technique
    c. select object viewing orientation
    d. select dimensioning layout
    e. select drawing type
2. ***Problem Solving:** Recognizes problems and devises and implements plan of action*
    a. answer assigned questions
    b. select types of view to describe object
3. ***Seeing Things In the Mind's Eye:** Organizes, and processes symbols, pictures, graphs, objects, and other information*
    a. interpret engineering drawings
    b. interpret technical illustrations and symbols
    c. understand written and oral instructions
4. ***Knowing How to Learn:** Use efficient learning techniques to acquire and apply new knowledge and skills*
    a. demonstrate mastery of basic skills and techniques
    b. use previously learned skills to support new skills
5. ***Reasoning:** Discovers a rule or principle underlying the relationship between two or more objects and applies it when solving a problem*
    a. understands that practice is vital to improving the skill of the student
    b. understands that the quality of the product is a function of the time of the operation and the attitude and skill of the student
    c. demonstrates ability to discriminate between positive and negative, and act accordingly

C. ***Personal Qualities:** Displays responsibility, self-esteem, sociability, self-management, and integrity and honesty.*

1. ***Responsibility:** Exerts a high level of effort and perseveres toward goal attainment*
    a. develops an understanding that in order to be successful you must be a “good” student
    b. develops an understanding that a “good” student is the one who is prompt to every class and has prepared for the day’s work
    c. develops an understanding good students know what they are going to do in class and does not waste time
    d. develops a fine work ethic
2. ***Self-Esteem:** Believes in own self-worth and maintains a positive view of self*
    a. learns to take pride in his or her work through positive reinforcement
    b. sees himself or herself as an asset to the class through continued contributions to the group and a shared common goal
    c. understands that an individual with a positive attitude and the belief in their own abilities will systematically seek solutions and be a valuable employee

3. *Sociability: Demonstrates understanding, friendliness, adaptability, empathy, and politeness in group settings*
    a. assist classmates in improving technical skills
    b. assist students with special needs as a peer mentor
    c. discusses and demonstrates strategies for effective communication across cultures
4. *Self-Management: Assesses self accurately, sets personal goals, monitors progress, and exhibits self-control*
    a. assesses self/personal goals and monitors individual progress
    b. maintain a record of academic achievement (individual grade book)
    c. performs goal setting activities
5. *Integrity/Honesty: Chooses ethical courses of action*
    a. accepts the responsibility for own actions
    b. exhibit personal honesty at all times
    c. accept the challenge of doing your own work in the laboratory, during examinations, and on outside assignments
    d. understand the consequences of unethical behavior

Appropriate Reference Materials:

1. Technical Drawing, D. L. Goetsch, J. A. Nelson, W. S. Chalk, 3rd Edition, Delmar Publishers, 1994
2. Technical Drawing, F. E. Giesecke, et al., 9th Edition, Macmillan, 1991
3. Machine Drafting and Design, R. H. Nickolaisen, Prentice-Hall, 1986
4. Geometric Dimensioning & Tolerancing for Engineering & Manufacturing Technology, C. Jensen, Delmar, 1993
5. Machinery's Handbook, E. Oberg, et al., 24th Edition, Industrial Press, Inc., 1992

*M*achine Tool *A*dvanced *S*kills
*T*echnology Program

MAST

COURSE SYLLABUS

INTRODUCTION TO COMPUTER-AIDED DRAFTING

MAST PROGRAM
COURSE SYLLABUS
INTRODUCTION TO COMPUTER-AIDED DRAFTING

Lecture hours/week: 1 **Lab hours/week: 4** **Credit hours: 3**

COURSE DESCRIPTION:

The student will be introduced to Computer-Aided Drafting and Design as an essential tool utilizing and enhancing the student's existing drafting skills. This is accomplished through the generation of two- and three-dimensional orthographic drawings, as well as pictorial techniques, in the CAD environment. Operating system commands, cursor manipulation, direct display interaction, geometry creation and manipulation, file storage and retrieval, entity manipulation such as rotation and mirroring, and the use of output devices such as printers and plotters are just a few of the hardware and software capabilities to be covered.

PREREQUISITES: **Introduction to Drafting; 15 hours in the Mechanical Design Drafting/CAD program, or one year professional drafting experience**

REQUIRED COURSE MATERIALS:

Textbook: Harnessing AutoCAD Release 13 for Windows, T. A. Stellman, G. V. Kirshman, R. A. Rhea, Delmar Publishers, Inc., 1994

Supplies:
3.5 High Density diskettes

METHODS OF INSTRUCTION:

Lecture: Didactic presentations will include lectures and instructor demonstrations.

Laboratory: Laboratory will be "hands-on" activities.

Method of Evaluation: A student's grade will be based on multiple measures of performance. The assessment will measure development of independent critical thinking skills and will include evaluation of the student's ability to:
1. perform the manipulative skills of the craft as required to satisfactorily complete assignments
2. apply theory to assignments
3. perform on written, oral, or practical examinations
4. perform on outside assignments, including writing assignments
5. contribute to class discussions
6. maintain attendance per current policy
7. follow all rules and safety regulations as stated in the manual

LECTURE OUTLINE

Lecture Topics	Text Reference Page	Contact Hrs.
Overview of CAD, computers (hardware/software), networks, lab configuration		1
Introduction to CAD; basic drawing and editing (single-view drawings)		1
Construct and modify commands		1
Edit and view commands; printing (multi-view drawings)		1
Layers, Linotypes and colors		1
Blocks; hatching		1
Multi-view orthographic drawing		1
Dimensioning		2
Paper space/model space		1
Drawing set-up, guidelines and tips		1
Advanced topics		1
Final Projects		—
	Total Lecture Hours	12

LAB OUTLINE

Lab Topics	Contact Hrs.
Overview of CAD, computers (hardware/software), networks, lab configuration	4
Introduction to CAD; basic drawing and editing (single-view drawings)	4
Construct and modify commands	4
Edit and view commands; printing (multi-view drawings)	4
Layers, Linotypes and colors	4
Blocks; hatching	4
Multi-view orthographic drawing	4
Dimensioning	8
Paper space/model space	4
Drawing set-up, guidelines and tips	4
Advanced topics	16
Final Projects	—
Total Lab Hours	60

COURSE OBJECTIVES: COURSE OBJECTIVES

After the successful completion of this course the student will be able to:

A. **APPLY MATHEMATICAL CONCEPTS**
  1. Perform Basic Arithmetic Operations
    a. Add, subtract, multiply and divide real numbers
    b. Add, subtract, multiply and divide fractions

- c. Convert real numbers to fractional equivalents and vice versa

2. Compute Unit Conversions
   - a. Convert English units to metric units and vice versa
3. Use Cartesian Coordinate System
   - a. Plot absolute coordinate data
   - b. Plot relative coordinate data
4. Use Polar Coordinate System
   - a. Plot absolute coordinate data
   - b. Plot relative coordinate data

B. DEMONSTRATE FUNDAMENTAL DRAFTING SKILLS

1. Use Drawing Media and Related Drafting Materials
   - a. Select drawing media
   - b. Select related drafting materials (e.g. pencil, triangles, lead,...)
2. Identify Drafting Line Styles and Weights (e.g., center, hidden, object, dimension)
   - a. Identify line styles
   - b. Apply line styles
3. Prepare Title Blocks and Other Drafting Forms
   - a. Identify and prepare title block
4. Create Technical Sketches
   - a. Identify and create orthographic drawings (single and multi-view)
   - b. Identify and create axonometric drawings (iso-, tri- and diametric)

C. PLAN AND ORGANIZE ACTIVITIES

1. Determine Scope of Drafting Assignment
   - a. Understand completion date
   - b. Identify number of drawings involved
   - c. Identify assignment requirements
   - d. Understand drawing responsibilities
2. Select Appropriate Drafting Techniques for Drawings
   - a. Identify types of drawings required
   - b. Identify types of materials needed

D. PREPARE MECHANICAL PRODUCTION DRAWINGS

1. Understand and Apply Mechanical Drawing Methods
   - a. Understand and apply multi-view orthographic projection
   - b. Understand and apply section views
   - c. Understand and apply auxiliary views

E. USE COMPUTER-AIDED DRAFTING SYSTEM

1. Start and exit a software program
   - a. Understand starting procedures
   - b. Understand exiting procedures
2. Demonstrate Proper File Management Techniques
   - a. Explain file management techniques
   - b. Demonstrate file management procedures
   - c. Format a floppy disk
3. Use Directory Structure
   - a. Identify directories and sub-directories
   - b. Create and delete directories
4. Edit Drawing File
   - a. Create new drawing file

    - b. Open existing drawing file
5. Utilize Drawing Set-Up Procedures
    - a. Identify drawing set-up parameters
    - b. Perform drawing set-up
6. Use Geometric Objects (e.g. lines, splines, circles,...)
    - a. Construct objects
    - b. Edit objects
    - c. Manipulate objects
7. Use Text for Drawing Annotation
    - a. Create text annotation
    - b. Edit text
8. Control Object Properties (color, line-type,...)
    - a. Determine object property
    - b. Modify object property
9. Use Viewing/Display Commands
    - a. Demonstrate view commands
    - b. Create multiple viewing windows
    - c. Demonstrate 3-D display procedures
10. Use Standard Parts and/or Symbol Libraries
    - a. Create parts/symbols
    - b. Create symbol libraries
    - c. Use standard parts/symbol libraries
11. Understand Procedure to Print/Plot a Drawing
    - a. Demonstrate plotting procedures
    - b. Determine scaling and layout
    - c. Use various printers and plotters
12. Use Standard Layering Techniques
    - a. Define standard layering procedures
    - b. Apply standard layering techniques
13. Create Mechanical CAD Drawings
    - a. Use CAD to create multi-view orthographic drawings
    - b. Understand 2-D multi-view drawing procedures on CAD system
14. Create 3-D Mechanical Models
    - a. Convert 2-D drawing information into 3-D
    - b. Create and edit wireframe model
15. Use Drawing Feature Attributes
    - a. Identify attribute data
    - b. Apply attribute data
    - c. Extract attribute data
16. Use CAD Dimensioning Features
    - a. Identify dimensioning variables
    - b. Set dimensioning variables
    - c. Use dimension drawings using CAD
    - d. Use dimensioning standards with CAD
    - e. Modify CAD dimensions
17. Perform CAD Customization Procedures
    - a. Identify customization techniques and procedures
    - b. Use customization techniques and procedures

COURSE OBJECTIVES: SCANS COMPETENCIES

The Secretary's Commission on Achieving Necessary Skills (SCANS), U. S. Department of Labor, has identified in its "AMERICA 2000 REPORT" that all students should develop a new set of competencies and foundation skills if they are to enjoy a productive, full and satisfying life. These are in addition to the Technical Workplace Competencies required by industry. SCANS is made up of five competencies and a three-part foundation of skills and personal qualities that are needed for solid job performance.

The following activities will be performed by each student for successful completion of this course:

I. **COMPETENCIES**
  A. ***Resources:*** *Identifies, organizes, plans, and allocates resources*
    1. follows a schedule to complete assigned tasks on time
    2. makes efficient use of computer resources such as disk space, file size and directory maintenance
  B. ***Interpersonal:*** *Works with others*
    1. work well with all members of class
  C. ***Information:*** *Acquires and uses information*
    1. read and understand CAD assignment
    2. organize and apply CAD/computer resources
    3. read and interpret CAD practices and standards
    4. use computer-aided design program to complete drafting assignment
  D. ***Systems:*** *Understands complex inter-relationships*
    1. understand the CAD system of drawing and designing
  E. ***Technology:*** *Works with a variety of technologies*
    1. chooses CAD application and settings to complete drafting assignment
    2. understand CAD set-up and customization procedures

II. **FOUNDATION SKILLS**
  A. ***Basic Skills:*** *Reads, writes, performs arithmetic and mathematical operations, listens and speaks.*
    1. ***Reading:*** *Locates, understands, and interprets written information in prose and in documents such as manuals, graphs, and schedules*
      a. reads and studies textbook
      b. reads manuals and reference sources
    2. ***Writing:*** *Communicates thoughts, ideas, information, and messages in writing and creates documents such as letters, directions, manuals, reports, graphs, and flow charts*
      a. write lecture notes
      b. submit written responses to assigned questions
      c. use proper CAD terminology
    3. ***Arithmetic/Mathematics:*** *Perform basic computations and approaches practical problems by choosing appropriately from a variety of mathematical techniques*

    a. calculate proper drawing spacing
    b. convert linear measurements from metric to English and English to metric
    c. scale drawing for plotting
    d. convert fractions to decimals
    e. measure drawn objects
  4. ***Listening:*** *Receives, attends to, interprets, and responds to verbal messages and other cues*
    a. assimilate classroom instruction
    b. interpret and assimilate video instruction
  5. ***Speaking:*** *Organizes ideas and communicates orally*
    a. participates in classroom discussions
    b. organize ideas and communicate specific questions to the instructor

B. ***Thinking Skills:*** *Thinks creatively, makes decisions, solves problems, visualizes, knows how to learn and reasons.*
  1. ***Decision Making:*** *Specifies goals and constraints, generates alternatives, considers risks, and evaluates and chooses best alternative*
    a. consider various arrangements and orientation for drawings
    b. select drafting technique
    c. select object viewing orientation
    d. select dimensioning layout
  2. ***Problem Solving:*** *Recognizes problems and devises and implements plan of action*
    a. answer assigned questions
    b. select types of view to describe object
  3. ***Seeing Things In the Mind's Eye:*** *Organizes, and processes symbols, pictures, graphs, objects, and other information*
    a. interpret engineering drawings
    b. interpret technical illustrations and symbols
    c. understand written and oral instructions
  4. ***Knowing How to Learn:*** *Use efficient learning techniques to acquire and apply new knowledge and skills*
    a. demonstrate mastery of basic skills and techniques
    b. use previously learned skills to support new skills
  5. ***Reasoning:*** *Discovers a rule or principle underlying the relationship between two or more objects and applies it when solving a problem*
    a. understands that practice is vital to improving the skill of the student
    b. understands that the quality of the product is a function of the time of the operation and the attitude and skill of the student
    c. demonstrates ability to discriminate between positive and negative, and act accordingly

C. ***Personal Qualities:*** *Displays responsibility, self-esteem, sociability, self-management, and integrity and honesty.*
  1. ***Responsibility:*** *Exerts a high level of effort and perseveres toward goal attainment*
    a. develops an understanding that in order to be successful you must be a "good" student

   - b. develops an understanding that a "good" student is the one who is prompt to every class and has prepared for the day's work
   - c. develops an understanding good students know what they are going to do in class and does not waste time
   - d. develops a fine work ethic

2. ***Self-Esteem:** Believes in own self-worth and maintains a positive view of self*
   - a. learns to take pride in his or her work through positive reinforcement
   - b. sees himself or herself as an asset to the class through continued contributions to the group and a shared common goal
   - c. understands that an individual with a positive attitude and the belief in their own abilities will systematically seek solutions and be a valuable employee
3. ***Sociability:** Demonstrates understanding, friendliness, adaptability, empathy, and politeness in group settings*
   - a. assist classmates in improving technical skills
   - b. assist students with special needs as a peer mentor
   - c. discusses and demonstrates strategies for effective communication across cultures
4. ***Self-Management:** Assesses self accurately, sets personal goals, monitors progress, and exhibits self-control*
   - a. assesses self/personal goals and monitors individual progress
   - b. maintain a record of academic achievement (individual grade book)
   - c. performs goal setting activities
5. ***Integrity/Honesty:** Chooses ethical courses of action*
   - a. accepts the responsibility for own actions
   - b. exhibit personal honesty at all times
   - c. accept the challenge of doing your own work in the laboratory, during examinations, and on outside assignments
   - d. understand the consequences of unethical behavior

Appropriate Reference Materials:

Any text covering mechanical drafting and design practices will be very useful, e.g.:

1. Technical Drawing by Giesecke, et al.
2. Engineering Drawing & Design by Jensen, et al.
3. Technical Drawing by Goetsche, et al.

*M*achine Tool *A*dvanced *S*kills
*T*echnology Program

MAST

COURSE SYLLABUS

DRAFTING SEMINAR

MAST PROGRAM
COURSE SYLLABUS
DRAFTING SEMINAR

Lecture hours/week: 1 **Lab hours/week: 0** **Credit hours: 1**

COURSE DESCRIPTION:

This course will discuss and address various strategies employed in a technical job search including database searches, resumes and assessment of benefits and wage scales.

Problems in dealing with subordinates, superiors, and peers.

Guest speakers will make presentations to explain selected fields within the drafting and mechanical design field.

PREREQUISITES: **24 Credit Hours in Degree Program**

COURSE OBJECTIVES

After the successful completion of this course the student will be able to:
1. Participate in drafting occupations with correct concepts of professional responsibilities.
2. Relate occupational experiences to professional growth.
3. Understand and utilize supervisory techniques.
4. Utilize working conditions as fully as possible.

REQUIRED COURSE MATERIALS: **NONE**

METHODS OF INSTRUCTION:

Lecture: Didactic presentations will include lectures and instructor demonstrations.

Method of Evaluation: A student's grade will be based on multiple measures of performance. The assessment will measure development of independent critical thinking skills and will include evaluation of the student's ability to:
1. perform the manipulative skills of the craft as required to satisfactorily complete assignments
2. apply theory to assignments
3. perform on written, oral, or practical examinations
4. perform on outside assignments, including writing assignments
5. contribute to class discussions
6. maintain attendance per current policy
7. follow all rules and safety regulations as stated in the manual

LECTURE OUTLINE

Lecture Topics	Text Reference Page	Contact Hrs.
Mechanical Design/CAD Careers		2
Guest Speaker		1
Job Ads		2
Speaker		1
Job Descriptions		1
Guest Speaker		1
Professional Resumes		2
Guest Speaker		1
Working Conditions		1
Guest Speaker		1
Interoffice Relations		1
Guest Speaker		1
	Total Lecture Hours	**15**

COURSE OBJECTIVES: SCANS COMPETENCIES

The Secretary's Commission on Achieving Necessary Skills (SCANS), U. S. Department of Labor, has identified in its "AMERICA 2000 REPORT" that all students should develop a new set of competencies and foundation skills if they are to enjoy a productive, full and satisfying life. These are in addition to the Technical Workplace Competencies required by industry. SCANS is made up of five competencies and a three-part foundation of skills and personal qualities that are needed for solid job performance.

The following activities will be performed by each student for successful completion of this course:

I. **COMPETENCIES**
  A. ***Resources:*** *Identifies, organizes, plans, and allocates resources*
    1. follows a schedule to complete assigned tasks on time
    2. record and maintain relevant job data
    3. acquire job data from local and national sources
    4. select appropriate job based on acquired skills and knowledge
  B. ***Interpersonal:*** *Works with others*
    1. work well with all members of class
  C. ***Information:*** *Acquires and uses information*
    1. acquire and evaluate job search data
    2. record and maintain job data
    3. read job description and select appropriate resume
    4. maintain computer job search resources (resume, cover letter, reply letter, ...)
  D. ***Systems:*** *Understands complex inter-relationships*
    1. understand the engineering design drafting system of drawing and designing
    2. monitors drafting and mechanical design career trends

E. Technology: Works with a variety of technologies
  1. use word processor to create job search correspondence

II. FOUNDATION SKILLS

A. ***Basic Skills:*** *Reads, writes, performs arithmetic and mathematical operations, listens and speaks.*
  1. ***Reading:*** *Locates, understands, and interprets written information in prose and in documents such as manuals, graphs, and schedules*
    a. reads and studies job search resources
    b. reads trade journals and reference sources
  2. ***Writing:*** *Communicates thoughts, ideas, information, and messages in writing and creates documents such as letters, directions, manuals, reports, graphs, and flow charts*
    a. write lecture notes
    b. submit written responses to assigned questions
    c. write job correspondence (resume, cover letter, ...)
  3. ***Arithmetic/Mathematics:*** *Perform basic computations and approaches practical problems by choosing appropriately from a variety of mathematical techniques*
    a. compute salary scale
    b. compute hourly work rate
  4. ***Listening:*** *Receives, attends to, interprets, and responds to verbal messages and other cues*
    a. assimilate classroom instruction
    b. interpret and assimilate video instruction
    c. interpret and respond to interview questions
  5. ***Speaking:*** *Organizes ideas and communicates orally*
    a. participates in classroom discussions
    b. organize ideas and communicate specific questions to the instructor

B. ***Thinking Skills:*** *Thinks creatively, makes decisions, solves problems, visualizes, knows how to learn and reasons.*
  1. ***Creative Thinking:*** *Generates new ideas*
    a. generate strategies for job search
    b. respond to interview questions
  2. ***Decision Making:*** *Specifies goals and constraints, generates alternatives, considers risks, and evaluates and chooses best alternative*
    a. generate strategies for job search
    b. choose response to interview questions
    c. choose type of job correspondence
  3. ***Problem Solving:*** *Recognizes problems and devises and implements plan of action*
    a. answer assigned questions
    b. choose response to interview questions
    c. choose type of job correspondence
  4. ***Seeing Things In the Mind's Eye:*** *Organizes, and processes symbols, pictures, graphs, objects, and other information*
    a. understand written and oral instructions
  5. ***Knowing How to Learn:*** *Use efficient learning techniques to acquire and apply new knowledge and skills*

  - a. demonstrate mastery of basic skills and techniques
  - b. use previously learned skills to support new skills
- 6. *Reasoning: Discovers a rule or principle underlying the relationship between two or more objects and applies it when solving a problem*
  - a. perform self analysis of effective learning skills
  - b. utilize techniques for effective creative thinking
  - c. develops strategies for effective problem solving

C. *Personal Qualities: Displays responsibility, self-esteem, sociability, self-management, and integrity and honesty.*

- *1. Responsibility: Exerts a high level of effort and perseveres toward goal attainment*
  - a. develops an understanding that in order to be successful you must be a "good" student
  - b. develops an understanding that a "good" student is the one who is prompt to every class and has prepared for the day's work
  - c. develops an understanding good students know what they are going to do in class and does not waste time
  - d. develops a fine work ethic
- *2. Self-Esteem: Believes in own self-worth and maintains a positive view of self*
  - a. learns to take pride in his or her work through positive reinforcement
  - b. sees himself or herself as an asset to the class through continued contributions to the group and a shared common goal
  - c. understands that an individual with a positive attitude and the belief in their own abilities will systematically seek solutions and be a valuable employee
- *3. Sociability: Demonstrates understanding, friendliness, adaptability, empathy, and politeness in group settings*
  - a. assist classmates in improving technical skills
  - b. assist students with special needs as a peer mentor
  - c. discusses and demonstrates strategies for effective communication across cultures
- *4. Self-Management: Assesses self accurately, sets personal goals, monitors progress, and exhibits self-control*
  - a. assesses self/personal goals and monitors individual progress
  - b. maintain a record of academic achievement (individual grade book)
  - c. performs goal setting activities
- *5. Integrity/Honesty: Chooses ethical courses of action*
  - a. accepts the responsibility for own actions
  - b. exhibit personal honesty at all times
  - c. accept the challenge of doing your own work in the laboratory, during examinations, and on outside assignments
  - d. understand the consequences of unethical behavior

*M*achine Tool *A*dvanced *S*kills
*T*echnology Program

MAST

COURSE SYLLABUS

3-D MODELING AND RENDERING

MAST PROGRAM
COURSE SYLLABUS
3-D MODELING AND RENDERING

Lecture hours/week: 2 **Lab hours/week: 3** **Credit hours: 3**

COURSE DESCRIPTION:

This course covers the basics of 3-D wireframe construction, surface modeling, solid modeling, and rendering. Students learn the concepts and techniques required to construct 3-D objects. These include 3-D Cartesian coordinate usage, spherical coordinate usage, surface and solids modeling. User world coordinate systems and multiple viewports are also discussed. Students construct a variety of objects using these techniques. Objects are rendered to slides and hard copies.

PREREQUISITES: **Composition I, Introduction to Drafting, Technical Mathematics, Introduction to Machine Tools, or consent of instructor**

COREQUISITES: **Introduction to Computer Aided Drafting**

REQUIRED COURSE MATERIALS:

Textbook: Modeling With AutoCAD Designer, Dobek, S., Ranschaert, R., Irwin, 1996

Supplies:
3-4 High Density 3 ½" computer disks

METHODS OF INSTRUCTION:

Lecture: Didactic presentations will include lectures and instructor demonstrations.

Laboratory: Laboratory will be "hands-on" activities.

Method of Evaluation: A student's grade will be based on multiple measures of performance. The assessment will measure development of independent critical thinking skills and will include evaluation of the student's ability to:

1. perform the manipulative skills of the craft as required to satisfactorily complete assignments
2. apply theory to assignments
3. perform on written, oral, or practical examinations
4. perform on outside assignments, including writing assignments
5. contribute to class discussions

6. maintain attendance per current policy
7. follow all rules and safety regulations as stated in the manual

LECTURE OUTLINE:

Lecture Topic	Text Reference Page	Contact Hrs.
Introduction and overview of computer software		1
File system management		1
3-D solid modeling concepts overview		2
a. Coordinate system entry methods		
b. Filtering		
3-D viewing		2
3-D solid modeling geometry construction		4
a. Extrusions		
b. Boolean Operations		
3-D solid modeling geometry construction		6
a. 3-D geometry editing		
3-D to 2-D conversion		4
a. Drawing layout		
b. Paper space/model space		
Constraints		2
a. Bi-directional associativity		
Surface modeling concepts		2
Surface modeling editing techniques		2
Rendering overview		4
a. Lights		
b. Cameras		
c. Shading		
d. Shadows		
Student project		2
	Total Lecture Hours	**32**

LAB OUTLINE:

Lab Topics	Contact Hrs,
Introduction and overview of computer software	1.5
File system management	1.5
3-D solid modeling concepts overview	3
a. Coordinate system entry methods	
b. Filtering	
3-D viewing	3
3-D solid modeling geometry construction	6

a. Extrusions	
b. Boolean Operations	
3-D solid modeling geometry construction	9
a. 3-D geometry editing	
3-D to 2-D conversion	6
a. Drawing layout	
b. Paper space/model space	
Constraints	3
a. Bi-directional associativity	
Surface modeling concepts	3
Surface modeling editing techniques	3
Rendering overview	6
a. Lights	
b. Cameras	
c. Shading	
d. Shadows	
Student project	15
Total Lab Hours	**60**

COURSE OBJECTIVES: TECHNICAL COMPETENCIES

After the successful completion of this course the student will be able to:

A. **APPLY MATHEMATICAL CONCEPTS**
  1. Perform Basic Arithmetic Operations
    a. Add, subtract, multiply and divide real numbers
    b. Add, subtract, multiply and divide fractions
    c. Convert real numbers to fractional equivalents and vice versa
  2. Compute Unit Conversions
    a. Convert English units to metric units and vice versa
  3. Use Cartesian Coordinate System
    a. Plot absolute coordinate data
    b. Plot relative coordinate data
  4. Use Polar Coordinate System
    a. Plot absolute coordinate data
    b. Plot relative coordinate data

B. **DEMONSTRATE FUNDAMENTAL DRAFTING SKILLS**
  1. Use Drawing Media and Related Drafting Materials
    a. Select drawing media
    b. Select related drafting materials (e.g. pencil, triangles, lead,...)
  2. Identify Drafting Line Styles and Weights (e.g., center, hidden, object, dimension)
    a. Identify line styles
    b. Apply line styles
  3. Prepare Title Blocks and Other Drafting Forms
    a. Identify and prepare title block
  4. Create Technical Sketches

- a. Identify and create orthographic drawings (single and multi-view)
- b. Identify and create axonometric drawings (iso-, tri- and dimetric)
- c. Identify and create perspective drawings (1, 2, and 3-point)

C. **PLAN AND ORGANIZE ACTIVITIES**

1. Determine Scope of Drafting Assignment
    - a. Understand completion date
    - b. Identify number of drawings involved
    - c. Identify assignment requirements
    - d. Understand drawing responsibilities
2. Select Appropriate Drafting Techniques for Drawings
    - a. Identify types of drawings required
    - b. Identify types of materials needed

D. **PREPARE MECHANICAL PRODUCTION DRAWINGS**

1. Understand and Apply Mechanical Drawing Methods
    - a. Understand and apply multi-view orthographic projection
    - b. Understand and apply section views
    - c. Understand and apply auxiliary views
2. Create Assembly Drawings
    - a. Understand and apply appropriate assembly drawing layout

E. **USE COMPUTER-AIDED DRAFTING SYSTEM**

1. Start and exit a software program
    - a. Understand starting procedures
    - b. Understand exiting procedures
2. Demonstrate Proper File Management Techniques
    - a. Explain file management techniques
    - b. Demonstrate file management procedures
    - c. Format a floppy disk
3. Use Directory Structure
    - a. Identify directories and sub-directories
    - b. Create and delete directories
4. Edit Drawing File
    - a. Create new drawing file
    - b. Open existing drawing file
5. Utilize Drawing Set-Up Procedures
    - a. Identify drawing set-up parameters
    - b. Perform drawing set-up
6. Use Geometric Objects (e.g. lines, splines, circles,...)
    - a. Construct objects
    - b. Edit objects
    - c. Manipulate objects
7. Use Text for Drawing Annotation
    - a. Create text annotation
    - b. Edit text
8. Control Object Properties (color, line-type,...)
    - a. Determine object property
    - b. Modify object property
9. Use Viewing/Display Commands

    - a. Demonstrate view commands
    - b. Create multiple viewing windows
    - c. Demonstrate 3-D display procedures

10. Use Standard Parts and/or Symbol Libraries
    - a. Create parts/symbols
    - b. Create symbol libraries
    - c. Use standard parts/symbol libraries
11. Understand Procedure to Print/Plot a Drawing
    - a. Demonstrate plotting procedures
    - b. Determine scaling and layout
    - c. Use various printers and plotters
12. Use Standard Layering Techniques
    - a. Define standard layering procedures
    - b. Apply standard layering techniques
13. Create Mechanical CAD Drawings
    - a. Use CAD to create multi-view orthographic drawings
    - b. Understand 2-D multi-view drawing procedures on CAD system
14. Create 3-D Mechanical Models
    - a. Convert 2-D drawing information into 3-D
    - b. Create and edit wireframe model
    - c. Create and edit 3-D surface model
    - d. Create and edit 3-D solid model
15. Utilize CAD Drawing Data
    - a. Translate CAD drawings into data file formate (DXF, IGES)
    - b. Import data files into CAD drawings
    - c. Query CAD data files
16. Obtain 3-D Model Property Data
    - a. Identify surface properties (surface, volume)
    - b. Extract surface properties
    - c. Identify mass properties (mom. of inertia, centroids, center of gravity)
    - d. Extract mass properties
17. Use Third-Party Software for CAD Enhancement
    - a. Identify third-party software
    - b. Use third-party software
18. Perform CAD Customization Procedures
    - a. Identify customization techniques and procedures
    - b. Use customization techniques and procedures

COURSE OBJECTIVES: SCANS COMPETENCIES

The Secretary's Commission on Achieving Necessary Skills (SCANS), U. S. Department of Labor, has identified in its "AMERICA 2000 REPORT" that all students should develop a new set of competencies and foundation skills if they are to enjoy a productive, full and satisfying life. These are in addition to the Technical Workplace Competencies required by industry.

SCANS is made up of five competencies and a three-part foundation of skills and personal qualities that are needed for solid job performance.

The following activities will be performed by each student for successful completion of this course:

I. **COMPETENCIES**
   - *A.* ***Resources:*** *Identifies, organizes, plans, and allocates resources*
     1. follows a schedule to complete assigned tasks on time
     2. make efficient use of computer resources such as disk space and processing time
   - *B.* ***Interpersonal:*** *Works with others*
     1. works well with all members of class
   - *C.* ***Information:*** *Acquires and uses information*
     1. read and understand CAD assignment
     2. organize and apply CAD/computer resources
     3. read and interpret CAD practices and standards
     4. use CAD design program to complete assignment
   - *D.* ***Systems:*** *Understands complex inter-relationships*
     1. understand the CAD system of drawing and designing
     2. understands computational limitation on CAD processing speed
     3. develops alternate strategies for efficient CAD processing
   - *E.* ***Technology:*** *Works with a variety of technologies*
     1. chooses CAD application and setting to complete assignment
     2. understand CAD set-up and customization

II. **FOUNDATION SKILLS**
   - *A.* ***Basic Skills:*** *Reads, writes, performs arithmetic and mathematical operations, listens and speaks.*
     - *1.* ***Reading:*** *Locates, understands, and interprets written information in prose and in documents such as manuals, graphs, and schedules*
       - a. reads and studies textbook
       - b. reads manuals and computer references
     - *2.* ***Writing:*** *Communicates thoughts, ideas, information, and messages in writing and creates documents such as letters, directions, manuals, reports, graphs, and flow charts*
       - a. write lecture notes
       - b. submit written responses to assigned questions
       - c. use proper CAD terminology
     - *3.* ***Arithmetic/Mathematics:*** *Perform basic computations and approaches practical problems by choosing appropriately from a variety of mathematical techniques*
       - a. use 2-D and 3-D coordinates
       - b. convert fractions to decimals
       - c. measure drawn objects
       - d. compute light intensities

4. ***Listening:*** *Receives, attends to, interprets, and responds to verbal messages and other cues*
    a. assimilate classroom instruction
    b. interpret and assimilate video instruction
5. ***Speaking:*** *Organizes ideas and communicates orally*
    a. participates in classroom discussions
    b. organize ideas and communicate specific questions to the instructor

B. ***Thinking Skills:*** *Thinks creatively, makes decisions, solves problems, visualizes, knows how to learn and reasons.*

1. ***Creative Thinking:*** *Generates new ideas*
    a. choose creative/realistic lighting and setting parameters
2. ***Decision Making:*** *Specifies goals and constraints, generates alternatives, considers risks, and evaluates and chooses best alternative*
    a. consider various arrangements for drawings
    b. select lighting layout
    c. select object viewing orientation
    d. select coloring scheme
3. ***Problem Solving:*** *Recognizes problems and devises and implements plan of action*
    a. answer assigned questions
    b. select types of view to describe object
4. ***Seeing Things In the Mind's Eye:*** *Organizes, and processes symbols, pictures, graphs, objects, and other information*
    a. interpret engineering drawings
    b. interpret technical illustrations and symbols
    c. understand written and oral instructions
5. ***Knowing How to Learn:*** *Use efficient learning techniques to acquire and apply new knowledge and skills*
    a. demonstrate mastery of basic skills and techniques
    b. use previously learned skills to support new skills
6. ***Reasoning:*** *Discovers a rule or principle underlying the relationship between two or more objects and applies it when solving a problem*
    a. understands that practice is vital to improving the skill of the student
    b. understands that the quality of the product is a function of the time of the operation and the attitude and skill of the student
    c. demonstrates ability to discriminate between positive and negative, and act accordingly

C. ***Personal Qualities:*** *Displays responsibility, self-esteem, sociability, self-management, and integrity and honesty.*

1. ***Responsibility:*** *Exerts a high level of effort and perseveres toward goal attainment*
    a. develops an understanding that in order to be successful you must be a "good" student
    b. develops an understanding that a "good" student is the one who is prompt to every class and has prepared for the day's work

   - c. develops an understanding good students know what they are going to do in class and does not waste time
   - d. develops a fine work ethic

2. ***Self-Esteem:*** *Believes in own self-worth and maintains a positive view of self*
   - a. learns to take pride in his or her work through positive reinforcement
   - b. sees himself or herself as an asset to the class through continued contributions to the group and a shared common goal
   - c. understands that an individual with a positive attitude and the belief in their own abilities will systematically seek solutions and be a valuable employee
3. ***Sociability:*** *Demonstrates understanding, friendliness, adaptability, empathy, and politeness in group settings*
   - a. assist classmates in improving technical skills
   - b. assist students with special needs as a peer mentor
   - c. discusses and demonstrates strategies for effective communication across cultures
4. ***Self-Management:*** *Assesses self accurately, sets personal goals, monitors progress, and exhibits self-control*
   - a. assesses self/personal goals and monitors individual progress
   - b. maintain a record of academic achievement (individual grade book)
   - c. performs goal setting activities
5. ***Integrity/Honesty:*** *Chooses ethical courses of action*
   - a. accepts the responsibility for own actions
   - b. exhibit personal honesty at all times
   - c. accept the challenge of doing your own work in the laboratory, during examinations, and on outside assignments
   - d. understands the consequences of unethical behavior

***M*achine Tool *A*dvanced *S*kills**
***T*echnology Program**

MAST

COURSE SYLLABUS

MATERIALS OF INDUSTRY

MAST PROGRAM
COURSE SYLLABUS
MATERIALS OF INDUSTRY

Lecture hours/week: 2 **Lab hours/week: 0** **Credit hours: 2**

COURSE DESCRIPTION:

Introduces types of and uses for industrial materials. Three general classifications of materials (ferrous metals, nonferrous metals, and composites) are studied emphasizing manufacture, properties, and industrial applications.

PREREQUISITES: **NONE**

REQUIRED COURSE MATERIALS:

Textbook: Fundamentals of Materials Science for Technologists, Horath, Larry., Prentice Hall, 1995

Supplies: None

METHODS OF INSTRUCTION:

Lecture: Didactic presentations will include lectures and instructor demonstrations.

Method of Evaluation: A students grade will be based on multiple measures of performance. The assessment will measure development of independent critical thinking skills and will include evaluation of the student's ability to:

1. perform the manipulative skills of the craft as required to satisfactorily complete assignments
2. apply theory to assignments
3. perform on written, oral, or practical examinations
4. perform on outside assignments, including writing assignments
5. contribute to class discussions
6. maintain attendance per current policy

LECTURE OUTLINE:

Lecture Topics	Text Reference Page	Contact Hrs.
Atomic, crystal & grain structures		2
Ferrous metals		4
Heat treatment		2
Non-ferrous metals		4
Polymers and elastomers		4
Wood and wood products		2

Ceramics	4
Cement, concrete and asphalt	4
Composites	2
Adhesives and coatings	2
Fuels and lubricants	2
Total Lecture Hours	**32**

COURSE OBJECTIVES: TECHNICAL COMPETENCIES

After the successful completion of this course the student will be able to:

A. **APPLY MATHEMATICAL CONCEPTS**
  1. Perform Basic Arithmetic Operations
    a. Add, subtract, multiply and divide real numbers
    b. Add, subtract, multiply and divide fractions
    c. Convert real numbers to fractional equivalents and vice versa
  2. Compute Unit Conversions
    a. Convert English units to metric units and vice versa
    b. Calculate unit conversion ratios
  3. Use Cartesian Coordinate System
    a. Plot absolute coordinate data
    b. Plot relative coordinate data
  4. Use Polar Coordinate System
    a. Plot absolute coordinate data
    b. Plot relative coordinate data

B. **ASSIST ENGINEERING PERSONNEL**
  1. Understand Basic Manufacturing Methods
    a. Identify types of manufacturing operation
    b. Understand application of manufacturing in drafting and design of machinery
    c. Prepare drawing for manufacturing application (e.g. casting drawings, forging drawings,...)

C. **USE COMPUTER-AIDED DRAFTING SYSTEM**
  1. Start and exit a software program
    a. Understand starting procedures
    b. Understand exiting procedures

COURSE OBJECTIVES: SCANS COMPETENCIES

The Secretary's Commission on Achieving Necessary Skills (SCANS), U. S. Department of Labor, has identified in its "AMERICA 2000 REPORT" that all students should develop a new set of competencies and foundation skills if they are to enjoy a productive, full and satisfying life. These are in addition to the Technical Workplace Competencies required by industry. SCANS is made up of five competencies and a three-part foundation of skills and personal qualities that are needed for solid job performance.

The following activities will be performed by each student for successful completion of this course:

I. COMPETENCIES

- *A.* ***Resources:*** *Identifies, organizes, plans, and allocates resources*
    1. follows a schedule to complete assigned tasks on time
    2. make efficient use of material resources and data
- *B.* ***Interpersonal:*** *Works with others*
    1. works well with all members of class
- *C.* ***Information:*** *Acquires and uses information*
    1. read and understand assignment
    2. organize and apply material resources and data
- *D.* ***Systems:*** *Understands complex inter-relationships*
    1. understand the relationship between material chemistry, material properties and manufacturing operations
- *E.* ***Technology:*** *Works with a variety of technologies*
    1. chooses CAD application and setting to complete drafting assignment
    2. understand CAD set-up and customization

II. FOUNDATION SKILLS

- *A.* ***Basic Skills:*** *Reads, writes, performs arithmetic and mathematical operations, listens and speaks.*
    - *1.* ***Reading:*** *Locates, understands, and interprets written information in prose and in documents such as manuals, graphs, and schedules*
        - a. reads and studies textbook
        - b. reads reference sources
    - *2.* ***Writing:*** *Communicates thoughts, ideas, information, and messages in writing and creates documents such as letters, directions, manuals, reports, graphs, and flow charts*
        - a. write lecture notes
        - b. submit written responses to assigned questions
        - c. use proper material science terminology
    - *3.* ***Arithmetic/Mathematics:*** *Perform basic computations and approaches practical problems by choosing appropriately from a variety of mathematical techniques*
        - a. perform stress and strain calculations
        - b. compute material composition (e.g. % impurities)
        - c. perform basic material properties - calculations (weight, volume, surface area, etc.)
        - d. compute material deformations due to loading
    - *4.* ***Listening:*** *Receives, attends to, interprets, and responds to verbal messages and other cues*
        - a. assimilate classroom instruction
        - b. interpret and assimilate video instruction
    - *5.* ***Speaking:*** *Organizes ideas and communicates orally*
        - a. participates in classroom discussions
        - b. organize ideas and communicate specific questions to the instructor

B. *Thinking Skills:* Thinks creatively, makes decisions, solves problems, visualizes, knows how to learn and reasons.

1. ***Decision Making:** Specifies goals and constraints, generates alternatives, considers risks, and evaluates and chooses best alternative*
    a. select solution procedure for assigned problems
    b. select appropriate materials for application
2. ***Problem Solving:** Recognizes problems and devises and implements plan of action*
    a. answer assigned questions
    b. recognize limitations of various material in given applications
    c. develop solutions to overcome limitations
3. ***Seeing Things In the Mind's Eye:** Organizes, and processes symbols, pictures, graphs, objects, and other information*
    a. interpret molecular diagrams/equilibrium diagrams
    b. interpret technical illustrations and symbols
    c. understand written and oral instructions
4. ***Knowing How to Learn:** Use efficient learning techniques to acquire and apply new knowledge and skills*
    a. demonstrate mastery of basic skills and techniques
    b. use previously learned skills to support new skills
5. ***Reasoning:** Discovers a rule or principle underlying the relationship between two or more objects and applies it when solving a problem*
    a. understand relationship between molecular structure of material and its physical properties

C. ***Personal Qualities:** Displays responsibility, self-esteem, sociability, self-management, and integrity and honesty.*

1. ***Responsibility:** Exerts a high level of effort and perseveres toward goal attainment*
    a. develops an understanding that in order to be successful you must be a "good" student
    b. develops an understanding that a "good" student is the one who is prompt to every class and has prepared for the day's work
    c. develops an understanding good students know what they are going to do in class and does not waste time
    d. develops a fine work ethic
2. ***Self-Esteem:** Believes in own self-worth and maintains a positive view of self*
    a. learns to take pride in his or her work through positive reinforcement
    b. sees himself or herself as an asset to the class through continued contributions to the group and a shared common goal
    c. understands that an individual with a positive attitude and the belief in their own abilities will systematically seek solutions and be a valuable employee
3. ***Sociability:** Demonstrates understanding, friendliness, adaptability, empathy, and politeness in group settings*
    a. assist classmates in improving technical skills
    b. assist students with special needs as a peer mentor

    c. discusses and demonstrates strategies for effective communication across cultures

4. *Self-Management: Assesses self accurately, sets personal goals, monitors progress, and exhibits self-control*
    a. assesses self/personal goals and monitors individual progress
    b. maintain a record of academic achievement (individual grade book)
    c. performs goal setting activities
5. *Integrity/Honesty: Chooses ethical courses of action*
    a. accepts the responsibility for own actions
    b. exhibit personal honesty at all times
    c. accept the challenge of doing your own work in the laboratory, during examinations, and on outside assignments
    d. understands the consequences of unethical behavior

Appropriate Reference Materials:

1. Practical Metallurgy and Materials of Industry, Neely, John E., 4th Ed., Prentice Hall, 1994

MET 104
04/080196

*M*achine Tool *A*dvanced *S*kills
*T*echnology Program

MAST

COURSE SYLLABUS

MACHINE ELEMENTS

MAST PROGRAM
COURSE SYLLABUS
MACHINE ELEMENTS

Lecture hours/week: 1 **Lab hours/week: 4** **Credit hours: 3**

COURSE DESCRIPTION:

Machine elements and basic mechanisms are topics in this study. Gears, cams, bearings, splines, linkages and motion producing devices are specifically studied.

PREREQUISITES: **Mechanical Detailing, Introduction to Computer Aided Drafting**

COREQUISITES: **Tool Drafting**

REQUIRED COURSE MATERIALS:

Textbook:	Engineering Drawing and Design, Jensen, C., Helsel, J.D., 5th Edition, Glencoe/McGraw-Hill, 1996
Supplies:	2-3 High Density 3 ½" computer disk

METHODS OF INSTRUCTION:

Lecture: Didactic presentations will include lectures and instructor demonstrations.

Laboratory: Laboratory will be "hands-on" activities.

Method of Evaluation: A student's grade will be based on multiple measures of performance. The assessment will measure development of independent critical thinking skills and will include evaluation of the student's ability to:

1. perform the manipulative skills of the craft as required to satisfactorily complete assignments
2. apply theory to assignments
3. perform on written, oral, or practical examinations
4. perform on outside assignments, including writing assignments
5. contribute to class discussions
6. maintain attendance per current policy
7. follow all rules and safety regulations as stated in the manual

LECTURE OUTLINE:

Lecture Topics	Text Reference Page	Contact Hrs.
Gear trains		1
a. Gear calculations		
b. Spur gears		

c. Bevel gears	
d. Worm gears	
V-Belts and pulleys	1
Chain drive system	1
Cams	1
Bearings	1
Splines	1
Linkages and motion devices	1
Total Lecture Hours	**16**

LAB OUTLINE:

Lab Topics	Contact Hrs.
Gear calculations	12
Spur gear drawing	8
Bevel gear drawing	8
Worm gear drawing	4
V-belts and pulleys	4
Chain drive systems	4
Cam drawing	12
Bearings	4
Linkages and motion devices	8
Total Lab Hours	**64**

COURSE OBJECTIVES: TECHNICAL COMPETENCIES

After the successful completion of this course the student will be able to:

A. **APPLY MATHEMATICAL CONCEPTS**
  1. Perform Basic Arithmetic Operations
    a. Add, subtract, multiply and divide real numbers
    b. Add, subtract, multiply and divide fractions
    c. Convert real numbers to fractional equivalents and vice versa
  2. Compute Unit Conversions
    a. Convert English units to metric units and vice versa
    b. Calculate unit conversion ratios
  3. Perform Basic Trigonometric Operations
    a. Use trigonometric functions to calculate angles
    b. Use trigonometric functions to calculate linear distances
  4. Use Cartesian Coordinate System
    a. Plot absolute coordinate data
    b. Plot relative coordinate data
  5. Use Polar Coordinate System
    a. Plot absolute coordinate data
    b. Plot relative coordinate data

B. **DEMONSTRATE FUNDAMENTAL DRAFTING SKILLS**
  1. Use Drawing Media and Related Drafting Materials
    a. Select drawing media
    b. Select related drafting materials (e.g. pencil, triangles, lead,...)

2. Prepare Title Blocks and Other Drafting Forms
    a. Identify and prepare title block
    b. Identify and prepare bill of material/parts list
    c. Identify and prepare revision history block
    d. Identify and prepare tolerance block
3. Create Technical Sketches
    a. Identify and create orthographic drawings (single and multi-view)

C. PLAN AND ORGANIZE ACTIVITIES

1. Determine Scope of Drafting Assignment
    a. Understand completion date
    b. Identify number of drawings involved
    c. Identify assignment requirements
    d. Understand drawing responsibilities
2. Select Appropriate Drafting Techniques for Drawings
    a. Identify types of drawings required
    b. Identify types of materials needed
3. Maintain Supporting Documents
    a. Identify supporting documents involved
    b. Understand document filing system
    c. Understand document responsibilities

D. PREPARE MECHANICAL PRODUCTION DRAWINGS

1. Understand and Apply Mechanical Drawing Methods
    a. Understand and apply multi-view orthographic projection
    b. Understand and apply section views
    c. Understand and apply auxiliary views
2. Perform Technical Lettering
    a. Understand technical lettering styles
    b. Identify and apply technical lettering styles
    c. Identify and apply standard notations
3. Create Bill of Material/Parts List
    a. Identify components included in bill of material/parts list
    b. Identify commercially available components in assembly
    c. Identify non-commercially available custom components in assembly
    d. Understand format of a bill of material/parts list
4. Apply Dimensions and Notes
    a. Identify dimensioning systems
    b. Understand and apply current dimensioning standards
    c. Understand dimensioning terminology
    d. Understand and apply detail dimensioning practices
    e. Understand and apply assembly dimensioning practices
5. Apply Dimensional Limits and Tolerances
    a. Understand tolerancing procedures
    b. Identify types of tolerances
    c. Apply tolerances to features
    d. Compute tolerance ranges
    e. Understand inch fit system
    f. Understand metric fit system
    g. Apply fit specifications to features
    h. Compute fits from tabular data and vice versa

        - i. Identify types of fits
    - 6. Apply Current Drafting Standards to Drawings
        - a. Understand relevant standards
        - b. Identify sources of standards
        - c. Reference standards
        - d. Apply relevant standards
    - 7. Perform Drawing Revisions
        - a. Understand reason for revisions
        - b. Apply revision notations
        - c. Complete revision documentation
    - 8. Use Commercial and Vendor Data
        - a. Understand commercial supplier catalogs
        - b. Understand vendor drawings

E. ASSIST ENGINEERING PERSONNEL

- 1. Utilize Fasteners (e.g. screws, bolts, nuts, seals, springs,...) for Mechanical Applications
    - a. Select appropriate fasteners and springs for application
    - b. Understand basic fastener and spring analysis
    - c. Identify types of fasteners and springs
    - d. Use supplier catalogs and standard references to select fasteners and springs for mechanical application
- 2. Utilize Power Transmission Elements (e.g. gears, cams, belts, chains, couplings, linkages,...) for mechanical applications
    - a. Select appropriate power transmission elements for application
    - b. Understand basic power transmission element analysis
    - c. Identify types of power transmission elements
    - d. Use supplier catalogs and standard references to select power transmission elements for mechanical application
- 3. Utilize Bearings for Mechanical Applications
    - a. Identify types of bearing devices
    - b. Understand basic bearing device analysis
    - c. Select appropriate bearing devices for applications
    - d. Use supplier catalogs and standard references to select bearing devices for mechanical applications

F. USE COMPUTER-AIDED DRAFTING SYSTEM

- 1. Demonstrate Proper File Management Techniques
    - a. Explain file management techniques
    - b. Demonstrate file management procedures
    - c. Format a floppy disk
- 2. Use Directory Structure
    - a. Identify directories and sub-directories
    - b. Create and delete directories
- 3. Edit Drawing File
    - a. Create new drawing file
    - b. Open existing drawing file
- 4. Utilize Drawing Set-Up Procedures
    - a. Identify drawing set-up parameters
    - b. Perform drawing set-up
- 5. Use Geometric Objects (e.g. lines, splines, circles,...)

    a. Construct objects
    b. Edit objects
    c. Manipulate objects

6. Use Text for Drawing Annotation
    a. Create text annotation
    b. Edit text
7. Control Object Properties (color, line-type,...)
    a. Determine object property
    b. Modify object property
8. Use Viewing/Display Commands
    a. Demonstrate view commands
9. Use Standard Parts and/or Symbol Libraries
    a. Create parts/symbols
    b. Create symbol libraries
    c. Use standard parts/symbol libraries
10. Understand Procedure to Print/Plot a Drawing
    a. Demonstrate plotting procedures
    b. Determine scaling and layout
    c. Use various printers and plotters
11. Use Standard Layering Techniques
    a. Define standard layering procedures
    b. Apply standard layering techniques
12. Create Mechanical CAD Drawings
    a. Use CAD to create multi-view orthographic drawings
    b. Understand 2-D multi-view drawing procedures on CAD system
13. Use CAD Dimensioning Features
    a. Identify dimensioning variables
    b. Set dimensioning variables
    c. Use dimension drawings using CAD
    d. Use dimensioning standards with CAD
    e. Modify CAD dimensions
14. Use Third-Party Software for CAD Enhancement
    a. Identify third-party software
    b. Use third-party software
15. Perform CAD Customization Procedures
    a. Identify customization techniques and procedures
    b. Use customization techniques and procedures

COURSE OBJECTIVES: SCANS COMPETENCIES

The Secretary's Commission on Achieving Necessary Skills (SCANS), U. S. Department of Labor, has identified in its "AMERICA 2000 REPORT" that all students should develop a new set of competencies and foundation skills if they are to enjoy a productive, full and satisfying life. These are in addition to the Technical Workplace Competencies required by industry. SCANS is made up of five competencies and a three-part foundation of skills and personal qualities that are needed for solid job performance.

The following activities will be performed by each student for successful completion of this course:

- I. **COMPETENCIES**
  - A. ***Resources:** Identifies, organizes, plans, and allocates resources*
    - 1. follows a schedule to complete assigned tasks on time
    - 2. make efficient use of drafting resources such as paper, leads and ink
  - B. ***Interpersonal:** Works with others*
    - 1. works well with all members of class
  - C. ***Information:** Acquires and uses inform*
    - 1. read and understand mechanical design assignment
    - 2. organize and apply mechanical design resources
    - 3. read and interpret drafting practices and standards
    - 4. use computer-aided design program to complete mechanical design assignment
  - D. ***Systems:** Understands complex inter-relationships*
    - 1. understand the engineering design drafting system of drawing and designing
  - E. ***Technology:** Works with a variety of technologies*
    - 1. chooses CAD application and setting to complete mechanical design assignment
    - 2. understand CAD set-up and customization

- II. **FOUNDATION SKILLS**
  - A. ***Basic Skills:** Reads, writes, performs arithmetic and mathematical operations, listens and speaks.*
    - *1.* ***Reading:** Locates, understands, and interprets written information in prose and in documents such as manuals, graphs, and schedules*
      - a. reads and studies textbook
      - b. reads manuals and reference sources
    - *2.* ***Writing:** Communicates thoughts, ideas, information, and messages in writing and creates documents such as letters, directions, manuals, reports, graphs, and flow charts*
      - a. write lecture notes
      - b. submit written responses to assigned questions
      - c. use proper engineering drafting/mechanical design terminology
    - *3.* ***Arithmetic/Mathematics:** Perform basic computations and approaches practical problems by choosing appropriately from a variety of mathematical techniques*
      - a. calculate proper drawing spacing
      - b. convert units from metric to English and English to metric
      - c. make basic engineering calculations (gear calculations, belt speed/size, cam/follower size,...)
      - d. convert fractions to decimals
      - e. measure drawn objects
    - *4.* ***Listening:** Receives, attends to, interprets, and responds to verbal messages and other cues*
      - a. assimilate classroom instruction
      - b. interpret and assimilate video instruction

5. ***Speaking:*** *Organizes ideas and communicates orally*
   a. participates in classroom discussions
   b. organize ideas and communicate specific questions to the instructor

B. ***Thinking Skills:*** *Thinks creatively, makes decisions, solves problems, visualizes, knows how to learn and reasons.*

1. ***Decision Making:*** *Specifies goals and constraints, generates alternatives, considers risks, and evaluates and chooses best alternative*
   a. consider various machine elements for design
   b. select proper elements given engineering data
   c. select dimensioning layout
2. ***Problem Solving:*** *Recognizes problems and devises and implements plan of action*
   a. answer assigned questions
   b. select types of view to describe object
3. ***Seeing Things In the Mind's Eye:*** *Organizes, and processes symbols, pictures, graphs, objects, and other information*
   a. interpret engineering drawings
   b. interpret technical illustrations and symbols
   c. understand written and oral instructions
4. ***Knowing How to Learn:*** *Use efficient learning techniques to acquire and apply new knowledge and skills*
   a. demonstrate mastery of basic skills and techniques
   b. use previously learned skills to support new skills
5. ***Reasoning:*** *Discovers a rule or principle underlying the relationship between two or more objects and applies it when solving a problem*
   a. understands that practice is vital to improving the skill of the student
   b. understands that the quality of the product is a function of the time of the operation and the attitude and skill of the student
   c. demonstrates ability to discriminate between positive and negative, and act accordingly

C. ***Personal Qualities:*** *Displays responsibility, self-esteem, sociability, self-management, and integrity and honesty.*

1. ***Responsibility:*** *Exerts a high level of effort and perseveres toward goal attainment*
   a. develops an understanding that in order to be successful you must be a "good" student
   b. develops an understanding that a "good" student is the one who is prompt to every class and has prepared for the day's work
   c. develops an understanding good students know what they are going to do in class and does not waste time
   d. develops a fine work ethic
2. ***Self-Esteem:*** *Believes in own self-worth and maintains a positive view of self*
   a. learns to take pride in his or her work through positive reinforcement
   b. sees himself or herself as an asset to the class through continued contributions to the group and a shared common goal

c. understands that an individual with a positive attitude and the belief in their own abilities will systematically seek solutions and be a valuable employee

3. *Sociability: Demonstrates understanding, friendliness, adaptability, empathy, and politeness in group settings*
    a. assist classmates in improving technical skills
    b. assist students with special needs as a peer mentor
    c. discusses and demonstrates strategies for effective communication across cultures
4. *Self-Management: Assesses self accurately, sets personal goals, monitors progress, and exhibits self-control*
    a. assesses self/personal goals and monitors individual progress
    b. maintain a record of academic achievement (individual grade book)
    c. performs goal setting activities
5. *Integrity/Honesty: Chooses ethical courses of action*
    a. accepts the responsibility for own actions
    b. exhibit personal honesty at all times
    c. accept the challenge of doing your own work in the laboratory, during examinations, and on outside assignments
    d. understands the consequences of unethical behavior

Appropriate Reference Materials:

1. W.S., Technical Drawing, Goetsch, D.L., Nelson, J.A., Chalk, 3rd Edition, Delmar Publishers, 1994
2. Machinery's Handbook, Oberg, E., et al., 24th Edition, Industrial Press, Inc., 1992

Machine Tool Advanced Skills Technology Program

MAST

COURSE SYLLABUS

TOOL DRAFTING

MAST PROGRAM
COURSE SYLLABUS
TOOL DRAFTING

Lecture hours/week: 1 **Lab hours/week: 4** **Credit hours: 3**

COURSE DESCRIPTION:

Introduction to die design, jig design, drawing theory, industrial applications, technical skills and typical practices in tool drawings.

PREREQUISITES: **NONE**

COREQUISITE: **Mechanical Detailing**

REQUIRED COURSE MATERIALS:

Textbook: Instructor supplies handouts

Supplies: 3.5" high-density disks

METHODS OF INSTRUCTION:

Lecture: Didactic presentations will include lectures and instructor demonstrations.

Laboratory: Laboratory will be "hands-on" activities.

Method of Evaluation: A student's grade will be based on multiple measures of performance. The assessment will measure development of independent critical thinking skills and will include evaluation of the student's ability to:

1. perform the manipulative skills of the craft as required to satisfactorily complete assignments
2. apply theory to assignments
3. perform on written, oral, or practical examinations
4. perform on outside assignments, including writing assignments
5. contribute to class discussions
6. maintain attendance per current policy
7. follow all rules and safety regulations as stated in the manual

LECTURE OUTLINE:

Lecture Topics	Text Reference Page	Contact Hrs.
Punches		2
a. Shoulder		
b. Ball lock		
Punch Holder		2

a. Die block	
b. Clearance	
Pierce Die	4
Drill Bushings	1
Drill Jig No. 1	2
Drill Jig No. 2	2
Drill Jig No. 3	3
Total Lecture Hours	**16**

LAB OUTLINE:

Lab Topics	**Contact Hrs.**
Punches	8
a. Shoulder	
b. Ball lock	
Punch Holder	8
a. Die block	
b. Clearance	
Pierce Die	16
Drill Bushings	4
Drill Jig No. 1	8
Drill Jig No. 2	8
Drill Jig No. 3	12
Total Lab Hours	**64**

COURSE OBJECTIVES: TECHNICAL COMPETENCIES

After the successful completion of this course the student will be able to:

A. APPLY MATHEMATICAL CONCEPTS
- 1. Perform Basic Arithmetic Operations
  - a. Add, subtract, multiply and divide real numbers
  - b. Add, subtract, multiply and divide fractions
  - c. Convert real numbers to fractional equivalents and vice versa
- 2. Compute Unit Conversions
  - a. Convert English units to metric units and vice versa
- 3. Use Cartesian Coordinate System
  - a. Plot absolute coordinate data
  - b. Plot relative coordinate data
- 4. Use Polar Coordinate System
  - a. Plot absolute coordinate data
  - b. Plot relative coordinate data

B. DEMONSTRATE FUNDAMENTAL DRAFTING SKILLS
- 1. Use Drawing Media and Related Drafting Materials
  - a. Select drawing media
  - b. Select related drafting materials (e.g. pencil, triangles, lead,...)
- 2.. Use Measuring Scales
  - a. Identify types of scales

    b. Select appropriate scale
    c. Use scales to measure and transfer dimensions
3. Identify Drafting Line Styles and Weights (e.g., center, hidden, object, dimension)
    a. Identify line styles
    b. Apply line styles
4. Prepare Title Blocks and Other Drafting Forms
    a. Identify and prepare title block
    b. Identify and prepare bill of material/parts list
5. Create Technical Sketches
    a. Identify and create orthographic drawings (single and multi-view)
    b. Identify and create axonometric drawings (iso-, tri- and dimetric)

C. PLAN AND ORGANIZE ACTIVITIES

1. Determine Scope of Drafting Assignment
    a. Understand completion date
    b. Identify number of drawings involved
    c. Identify assignment requirements
    d. Understand drawing responsibilities
2. Select Appropriate Drafting Techniques for Drawings
    a. Identify types of drawings required
    b. Identify types of materials needed
3. Maintain Supporting Documents
    a. Identify supporting documents involved
    b. Understand document filing system
    c. Understand document responsibilities

D. PREPARE MECHANICAL PRODUCTION DRAWINGS

1. Understand and Apply Mechanical Drawing Methods
    a. Understand and apply multi-view orthographic projection
    b. Understand and apply section views
    c. Understand and apply auxiliary views
2. Create Detail Drawings
    a. Understand and apply detail drawing methods
    b. Identify types of detail drawings
    c. Understand layout of detail drawings
    d. Identify individual parts for detailing
    e. Understand role of the manufacturing process in the detail drawings
    f. Identify part dimensions from drawings
3. Create Assembly Drawings
    a. Identify types of assembly drawings
    b. Understand and apply appropriate assembly drawing layout
    c. Understand and apply assembly drawing practices
4. Perform Technical Lettering
    a. Understand technical lettering styles
    b. Identify and apply technical lettering styles
    c. Identify and apply standard notations
5. Create Bill of Material/Parts List
    a. Identify components included in bill of material/parts list
    b. Identify commercially available components in assembly
    c. Identify non-commercially available custom components in assembly

        - d. Understand format of a bill of material/parts list
    - 6. Apply Dimensions and Notes
        - a. Identify dimensioning systems
        - b. Understand and apply current dimensioning standards
        - c. Understand dimensioning terminology
        - d. Understand and apply detail dimensioning practices
        - e. Understand and apply assembly dimensioning practices
    - 7. Apply Dimensional Limits and Tolerances
        - a. Understand tolerancing procedures
        - b. Identify types of tolerances
        - c. Apply tolerances to features
        - d. Compute tolerance ranges
        - e. Understand inch fit system
        - f. Understand metric fit system
        - g. Apply fit specifications to features
        - h. Compute fits from tabular data and vice versa
        - i. Identify types of fits
    - 8. Apply Current Drafting Standards to Drawings
        - a. Understand relevant standards
        - b. Identify sources of standards
        - c. Reference standards
        - d. Apply relevant standards
    - 9. Use Commercial and Vendor Data
        - a. Understand commercial supplier catalogs
        - b. Understand vendor drawings

E. ASSIST ENGINEERING PERSONNEL

- 1. Utilize Fasteners (e.g. screws, bolts, nuts, seals, springs,...) for Mechanical Applications
    - a. Select appropriate fasteners and springs for application
    - b. Understand basic fastener and spring analysis
    - c. Identify types of fasteners and springs
    - d. Use supplier catalogs and standard references to select fasteners and springs for mechanical application
- 2. Understand Basic Manufacturing Methods
    - a. Identify types of manufacturing operation
    - b. Understand application of manufacturing in drafting and design of machinery
    - c. Prepare drawing for manufacturing application (e.g. casting drawings, forging drawings,...)

F. USE COMPUTER-AIDED DRAFTING SYSTEM

- 1. Start and exit a software program
    - a. Understand starting procedures
    - b. Understand exiting procedures
- 2. Demonstrate Proper File Management Techniques
    - a. Explain file management techniques
    - b. Demonstrate file management procedures
    - c. Format a floppy disk
- 3. Use Directory Structure

    a. Identify directories and sub-directories
    b. Create and delete directories
4. Edit Drawing File
    a. Create new drawing file
    b. Open existing drawing file
5. Utilize Drawing Set-Up Procedures
    a. Identify drawing set-up parameters
    b. Perform drawing set-up
6. Use Geometric Objects (e.g. lines, splines, circles,...)
    a. Construct objects
    b. Edit objects
    c. Manipulate objects
7. Use Text for Drawing Annotation
    a. Create text annotation
    b. Edit text
8. Control Object Properties (color, line-type,...)
    a. Determine object property
    b. Modify object property
9. Use Viewing/Display Commands
    a. Demonstrate view commands
10. Use Standard Parts and/or Symbol Libraries
    a. Create parts/symbols
    b. Create symbol libraries
    c. Use standard parts/symbol libraries
11. Understand Procedure to Print/Plot a Drawing
    a. Demonstrate plotting procedures
    b. Determine scaling and layout
    c. Use various printers and plotters
12. Use Standard Layering Techniques
    a. Define standard layering procedures
    b. Apply standard layering techniques
13. Create Mechanical CAD Drawings
    a. Use CAD to create multi-view orthographic drawings
    b. Understand 2-D multi-view drawing procedures on CAD system
14. Use CAD Dimensioning Features
    a. Identify dimensioning variables
    b. Set dimensioning variables
    c. Use dimension drawings using CAD
    d. Use dimensioning standards with CAD
    e. Modify CAD dimensions
15. Use Third-Party Software for CAD Enhancement
    a. Identify third-party software
    b. Use third-party software
16. Perform CAD Customization Procedures
    a. Identify customization techniques and procedures
    b. Use customization techniques and procedures

COURSE OBJECTIVES: SCANS COMPETENCIES

The Secretary's Commission on Achieving Necessary Skills (SCANS), U. S. Department of Labor, has identified in its "AMERICA 2000 REPORT" that all students should develop a new set of competencies and foundation skills if they are to enjoy a productive, full and satisfying life. These are in addition to the Technical Workplace Competencies required by industry. SCANS is made up of five competencies and a three-part foundation of skills and personal qualities that are needed for solid job performance.

The following activities will be performed by each student for successful completion of this course:

I. COMPETENCIES

- *A.* ***Resources:** Identifies, organizes, plans, and allocates resources*
  1. follows a schedule to complete assigned tasks on time
  2. make efficient use of drafting resources such as paper, leads and ink
- *B.* ***Interpersonal:** Works with others*
  1. works well with all members of class
- *C.* ***Information:** Acquires and uses information*
  1. read and understand drafting assignment
  2. organize and apply drafting resources
  3. read and interpret drafting practices and standards
  4. ise computer-aided design program to complete drafting assignment
- *D.* ***Systems:** Understands complex inter-relationships*
  1. understand the engineering design drafting system of drawing and designing
- *E.* ***Technology:** Works with a variety of technologies*
  1. chooses CAD application and setting to complete drafting assignment
  2. understand CAD set-up and customization

II. FOUNDATION SKILLS

- *A.* ***Basic Skills:** Reads, writes, performs arithmetic and mathematical operations, listens and speaks.*
  1. ***Reading:** Locates, understands, and interprets written information in prose and in documents such as manuals, graphs, and schedules*
     - a. reads and studies textbook
     - b. reads catalogs and reference sources
  2. ***Writing:** Communicates thoughts, ideas, information, and messages in writing and creates documents such as letters, directions, manuals, reports, graphs, and flow charts*
     - a. write lecture notes
     - b. submit written responses to assigned questions
     - c. use proper engineering drafting terminology
  3. ***Arithmetic/Mathematics:** Perform basic computations and approaches practical problems by choosing appropriately from a variety of mathematical techniques*
     - a. calculate proper drawing spacing

- b. convert linear measurements from metric to English and English to metric
- c. scale drawing
- d. convert fractions to decimals
- e. measure drawn objects

4. ***Listening:*** *Receives, attends to, interprets, and responds to verbal messages and other cues*
- a. assimilate classroom instruction
- b. interpret and assimilate video instruction

5. ***Speaking:*** *Organizes ideas and communicates orally*
- a. participates in classroom discussions
- b. organize ideas and communicate specific questions to the instructor

B. ***Thinking Skills:*** *Thinks creatively, makes decisions, solves problems, visualizes, knows how to learn and reasons.*

1. ***Decision Making:*** *Specifies goals and constraints, generates alternatives, considers risks, and evaluates and chooses best alternative*
- a. consider various arrangements orientation for drawings
- b. select drafting technique
- c. select object viewing orientation
- d. select dimensioning layout

2. ***Problem Solving:*** *Recognizes problems and devises and implements plan of action*
- a. answer assigned questions
- b. select types of view to describe object

3. ***Seeing Things In the Mind's Eye:*** *Organizes, and processes symbols, pictures, graphs, objects, and other information*
- a. interpret engineering drawings
- b. interpret technical illustrations and symbols
- c. understand written and oral instructions

4. ***Knowing How to Learn:*** *Use efficient learning techniques to acquire and apply new knowledge and skills*
- a. demonstrate mastery of basic skills and techniques
- b. use previously learned skills to support new skills

5. ***Reasoning:*** *Discovers a rule or principle underlying the relationship between two or more objects and applies it when solving a problem*
- a. apply tool drafting fundamentals to real-world problems

C. ***Personal Qualities:*** *Displays responsibility, self-esteem, sociability, self-management, and integrity and honesty.*

1. ***Responsibility:*** *Exerts a high level of effort and perseveres toward goal attainment*
- a. develops an understanding that in order to be successful you must be a “good” student
- b. develops an understanding that a “good” student is the one who is prompt to every class and has prepared for the day’s work
- c. develops an understanding good students know what they are going to do in class and does not waste time
- d. develops a fine work ethic

2. *Self-Esteem: Believes in own self-worth and maintains a positive view of self*
   a. learns to take pride in his or her work through positive reinforcement
   b. sees himself or herself as an asset to the class through continued contributions to the group and a shared common goal
   c. understands that an individual with a positive attitude and the belief in their own abilities will systematically seek solutions and be a valuable employee
3. *Sociability: Demonstrates understanding, friendliness, adaptability, empathy, and politeness in group settings*
   a. assist classmates in improving technical skills
   b. assist students with special needs as a peer mentor
   c. discusses and demonstrates strategies for effective communication across cultures
4. *Self-Management: Assesses self accurately, sets personal goals, monitors progress, and exhibits self-control*
   a. assesses self/personal goals and monitors individual progress
   b. maintain a record of academic achievement (individual grade book)
   c. performs goal setting activities
5. *Integrity/Honesty: Chooses ethical courses of action*
   a. accepts the responsibility for own actions
   b. exhibit personal honesty at all times
   c. accept the challenge of doing your own work in the laboratory, during examinations, and on outside assignments
   d. understands the consequences of unethical behavior

***M**achine Tool **A**dvanced **S**kills*
***T**echnology Program*

MAST

COURSE SYLLABUS

HYDRAULICS AND PNEUMATICS

MAST PROGRAM

COURSE SYLLABUS
HYDRAULICS AND PNEUMATICS

Lecture hours/week: 2 **Lab hours/week: 1** **Credit hours: 2**

COURSE DESCRIPTION:

The study of the basic theory and applications of hydraulic and pneumatic components and circuits. Special attention is given to the design and application of hydraulics and pneumatics for power transmission and the control of industrial processes.

PREREQUISITES: **Mechanics, Heat and Sound; Technical Mathematics**

COREQUISITES: **Machine Design**

REQUIRED COURSE MATERIALS:

Textbooks:	Hydraulic Technology, Parker, Bulletin 0221-B1 Ind. Pneumatic Technology, Parker, Bulletin 0275-B4 Ind.
Supplies:	None

METHODS OF INSTRUCTION:

Lecture: Didactic presentations will include lectures and instructor demonstrations.

Laboratory: Laboratory will be "hands-on" activities.

Method of Evaluation: A student's grade will be based on multiple measures of performance. The assessment will measure development of independent critical thinking skills and will include evaluation of the student's ability to:

1. perform the manipulative skills of the craft as required to satisfactorily complete assignments
2. apply theory to assignments
3. perform on written, oral, or practical examinations
4. perform on outside assignments, including writing assignments
5. contribute to class discussions
6. maintain attendance per current policy
7. follow all rules and safety regulations as stated in the manual

LECTURE OUTLINE:

Lecture Topics	Text Reference Page	Contact Hrs.
Hydraulic Principles		4
Pump Theory		2

Motors		2
Actuators		2
Directional Controls		4
Pressure Controls		2
Flow Controls		4
Reservoirs, Coolers, Filters		2
Check Valves, Accumulators, Cylinders		4
Control Pneumatic Energy		4
Energy Transmission		2
Compressors		4
Aftercoolers		4
Regulators		4
Air Preparation		2
	Total Lecture Hours	**48**

LAB OUTLINE:

Lab Topics		Contact Hrs.
Hydraulic Principles		1
Pump Theory		6
Reservoirs, Coolers, Filters		3
Energy Transmission		2
Aftercoolers		2
Air Preparation		1
	Total Lab Hours	**15**

COURSE OBJECTIVES: TECHNICAL COMPETENCIES

After the successful completion of this course the student will be able to:

A. APPLY MATHEMATICAL CONCEPTS

1. Perform Basic Arithmetic Operations
    a. Add, subtract, multiply and divide real numbers
    b. Add, subtract, multiply and divide fractions
    c. Convert real numbers to fractional equivalents and vice versa
2. Compute Unit Conversions
    a. Convert English units to metric units and vice versa
    b. Calculate unit conversion ratios
3. Use Cartesian Coordinate System
    a. Plot absolute coordinate data
    b. Plot relative coordinate data
4. Use Polar Coordinate System
    a. Plot absolute coordinate data
    b. Plot relative coordinate data

B. USE COMPUTER-AIDED DRAFTING SYSTEM

1. Start and exit a software program
    a. Understand starting procedures
    b. Understand exiting procedures

COURSE OBJECTIVES: SCANS COMPETENCIES

The Secretary's Commission on Achieving Necessary Skills (SCANS), U. S. Department of Labor, has identified in its "AMERICA 2000 REPORT" that all students should develop a new set of competencies and foundation skills if they are to enjoy a productive, full and satisfying life. These are in addition to the Technical Workplace Competencies required by industry. SCANS is made up of five competencies and a three-part foundation of skills and personal qualities that are needed for solid job performance.

The following activities will be performed by each student for successful completion of this course:

I. **COMPETENCIES**
  A. ***Resources:*** *Identifies, organizes, plans, and allocates resources*
    1. follows a schedule to complete assigned tasks on time
    2. make efficient use of resources such as book, manuals, periodicals
  B. ***Interpersonal:*** *Works with others*
    1. works well with all members of class
  C. ***Information:*** *Acquires and uses information*
    1. read and understand assignment
    2. organize and apply resources
    3. read and interpret hydraulics and pneumatics practices and standards
  D. ***Systems:*** *Understands complex inter-relationships*
    1. understands operation of hydraulic and pneumatic systems
    2. operates hydraulic and pneumatic system according to prescribed requirements
  E. ***Technology:*** *Works with a variety of technologies*
    1. chooses operating procedures for hydraulic and pneumatic systems
    2. set-up and operate equipment

II. **FOUNDATION SKILLS**
  A. ***Basic Skills:*** *Reads, writes, performs arithmetic and mathematical operations, listens and speaks.*
    1. ***Reading:*** *Locates, understands, and interprets written information in prose and in documents such as manuals, graphs, and schedules*
      a. reads and studies textbook
      b. reads manuals and reference sources
    2. ***Writing:*** *Communicates thoughts, ideas, information, and messages in writing and creates documents such as letters, directions, manuals, reports, graphs, and flow charts*
      a. write lecture notes
      b. submit written responses to assigned questions
      c. use proper hydraulic and pneumatic terminology
    3. ***Arithmetic/Mathematics:*** *Perform basic computations and approaches practical problems by choosing appropriately from a variety of mathematical techniques*

        - a. perform flow and volume computations
        - b. calculate hydraulic and pneumatic component size
        - c. compute system specification requirements
    - 4. ***Listening:** Receives, attends to, interprets, and responds to verbal messages and other cues*
        - a. assimilate classroom instruction
        - b. interpret and assimilate video instruction
    - 5. ***Speaking:** Organizes ideas and communicates orally*
        - a. participates in classroom discussions
        - b. organize ideas and communicate specific questions to the instructor
- B. ***Thinking Skills:** Thinks creatively, makes decisions, solves problems, visualizes, knows how to learn and reasons.*
    - 1. ***Creative Thinking:** Generates new ideas*
        - a. devise new flow systems for assigned problems
    - 2. ***Decision Making:** Specifies goals and constraints, generates alternatives, considers risks, and evaluates and chooses best alternative*
        - a. consider various system configurations
        - b. select proper components from specifications and requirements
        - c. select proper operation of system
    - 3. ***Problem Solving:** Recognizes problems and devises and implements plan of action*
        - a. answer assigned questions
        - b. recognize limitations of components and suggest alternatives
        - c. select best arrangement of components for system
    - 4. ***Seeing Things In the Mind's Eye:** Organizes, and processes symbols, pictures, graphs, objects, and other information*
        - a. interpret flow diagrams
        - b. interpret technical illustrations and symbols
        - c. understand written and oral instructions
    - 5. ***Knowing How to Learn:** Use efficient learning techniques to acquire and apply new knowledge and skills*
        - a. demonstrate mastery of basic skills and techniques
        - b. use previously learned skills to support new skills
    - 6. ***Reasoning:** Discovers a rule or principle underlying the relationship between two or more objects and applies it when solving a problem*
        - a. understand the effects various components have on whole system
        - b. understands relationship of flow equations to real-world applications
- C. ***Personal Qualities:** Displays responsibility, self-esteem, sociability, self-management, and integrity and honesty.*
    - 1. ***Responsibility:** Exerts a high level of effort and perseveres toward goal attainment*
        - a. develops an understanding that in order to be successful you must be a "good" student
        - b. develops an understanding that a "good" student is the one who is prompt to every class and has prepared for the day's work
        - c. develops an understanding good students know what they are going to do in class and does not waste time

    d. develops a fine work ethic

2. *Self-Esteem: Believes in own self-worth and maintains a positive view of self*
    a. learns to take pride in his or her work through positive reinforcement
    b. sees himself or herself as an asset to the class through continued contributions to the group and a shared common goal
    c. understands that an individual with a positive attitude and the belief in their own abilities will systematically seek solutions and be a valuable employee
3. *Sociability: Demonstrates understanding, friendliness, adaptability, empathy, and politeness in group settings*
    a. assist classmates in improving technical skills
    b. assist students with special needs as a peer mentor
    c. discusses and demonstrates strategies for effective communication across cultures
4. *Self-Management: Assesses self accurately, sets personal goals, monitors progress, and exhibits self-control*
    a. assesses self/personal goals and monitors individual progress
    b. maintain a record of academic achievement (individual grade book)
    c. performs goal setting activities
5. *Integrity/Honesty: Chooses ethical courses of action*
    a. accepts the responsibility for own actions
    b. exhibit personal honesty at all times
    c. accept the challenge of doing your own work in the laboratory, during examinations, and on outside assignments
    d. understands the consequences of unethical behavior

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MAST

COURSE SYLLABUS

TRIGONOMETRIC FUNCTIONS

MAST PROGRAM
COURSE SYLLABUS
TRIGONOMETRIC FUNCTIONS

Lecture hours/week: 2 **Lab hours/week: 0** **Credit hours: 2**

COURSE DESCRIPTION:

This course is a study of the trigonometric functions, inverse trigonometric functions and appropriate applications. The concepts that will prepare a student for calculus are emphasized.

PREREQUISITES: **College Algebra (Functions)**

REQUIRED COURSE MATERIALS:

Textbook: Technical Mathematics, John C. Peterson, 1994

Supplies: None

METHODS OF INSTRUCTION:

Lecture: Didactic presentations will include lectures and instructor demonstrations.

Method of Evaluation: A student's grade will be based on multiple measures of performance. The assessment will measure development of independent critical thinking skills and will include evaluation of the student's ability to:

1. perform on written, oral, or practical examinations
2. perform on outside assignments, including writing assignments
3. contribute to class discussions
4. maintain attendance per current policy

LECTURE OUTLINE:

Lecture Topics	Text Reference Page	Contact Hrs.
Real Number Systems: Sets, Exponents, Scientific Notation, Root and Radicals		10
Algebraic Concepts: Simplifying Expressions, First-degree Equations, and word problems		10
Geometric Applications: Areas, Perimeters and Volume		5
Rectangular Coordinate System: Relations, Functions and		

Functional Notation and Graphs	10
Systems of equations: Matrices, Determinants, Cramer's Rule and World Problems	10
Similar Figures: Variation - Direct, Inverse and Joint	10
Factoring: Linear, Quadratic and Cubic	10
Fractional Equations and Extraneous Roots, Quadratic Equations and Quadratic Formula	10
Logarithm Function: Basic Properties and Principles, Inverse of power function	5
Imaginary and Complex Numbers	5
Total Lecture Hours	**85**

COURSE OBJECTIVES: TECHNICAL COMPETENCIES

After the successful completion of this course the student will be able to:

A. APPLY MATHEMATICAL CONCEPTS

1. Perform Basic Arithmetic Operations
    a. Add, subtract, multiply and divide real numbers
    b. Add, subtract, multiply and divide fractions
    c. Convert real numbers to fractional equivalents and vice versa
2. Compute Unit Conversions
    a. Convert English units to metric units and vice versa
3. Perform Basic Trigonometric Operations
    a. Use trigonometric functions to calculate angles
    b. Use trigonometric functions to calculate linear distances
4. Use Cartesian Coordinate System
    a. Plot absolute coordinate data
    b. Plot relative coordinate data
5. Use Polar Coordinate System
    a. Plot absolute coordinate data
    b. Plot relative coordinate data

COURSE OBJECTIVES: SCANS COMPETENCIES

The Secretary's Commission on Achieving Necessary Skills (SCANS), U. S. Department of Labor, has identified in its "AMERICA 2000 REPORT" that all students should develop a new set of competencies and foundation skills if they are to enjoy a productive, full and satisfying life. These are in addition to the Technical Workplace Competencies required by industry. SCANS is made up of five competencies and a three-part foundation of skills and personal qualities that are needed for solid job performance.

The following activities will be performed by each student for successful completion of this course:

I. COMPETENCIES

- A. ***Resources:*** *Identifies, organizes, plans, and allocates resources*
  - 1. follows a schedule to complete assigned tasks on time
  - 2. provide a self-evaluation of performance based on the time and quality of work
  - 3. assesses own skills to determine when to get extra help or use the math lab with videos, computers, tutorials, etc.
- B. ***Interpersonal:*** *Works with others*
  - 1. participates in classroom dialogue, contributing to group effort in problem solving
  - 2. works well with all members of class
  - 3. communicates ideas on take-home exams to justify answers
- C. ***Information:*** *Acquires and uses information*
  - 1. apply mathematical solutions to problems assigned
  - 2. organize and maintain lecture notebook and assignment notebook
  - 3. communicates and interprets information by participating in classroom dialogue
  - 4. acquires math material from the text, videos, and computers
  - 5. interprets information in problem solving situations on homework, lab worksheets, and exams
- D. ***Systems:*** *Understands complex inter-relationships*
  - 1. understands systems:
    - a. applies a systematic approach to solving mathematical problems
    - b. develops an understanding of mathematical system complexity with applications to algebra, geometry, and trigonometric equation solving
    - c. operates within the organizational system of the class procedures to fulfill the requirements to pass the course
    - d. monitors own progress in the class and understanding of math concepts to know when to seek additional help

II. FOUNDATION SKILLS

- A. ***Basic Skills:*** *Reads, writes, performs arithmetic and mathematical operations, listens and speaks.*
  - 1. ***Reading:*** *Locates, understands, and interprets written information in prose and in documents such as manuals, graphs, and schedules*
    - a. interprets word problems, tables, graphs, and drawings to identify presented problem(s)
    - b. reads and studies textbook, available tutorials, and video tapes
    - c. uses available tutorials in the laboratory as needed
  - 2. ***Writing:*** *Communicates thoughts, ideas, information, and messages in writing and creates documents such as letters, directions, manuals, reports, graphs, and flow charts*

        - a. communicates problem solving skills by solving mathematical problems in writing using presented information
        - b. maintains a lecture notebook
        - c. completes all written assignments
        - d. completes examinations, including definitions, problem solving, and concept explanations
        - e. submits written responses to chapter question assignments
    - 3. ***Arithmetic/Mathematics:*** *Perform basic computations and approaches practical problems by choosing appropriately from a variety of mathematical techniques*
        - a. adds, subtracts, multiplies, and divides all numbers in the complex number system, algebraic expressions, equations, and functions
        - b. analyzes and graphs functions and equations
        - c. solves application problems using algebraic, analytic, and geometric techniques
        - d. solves equations algebraically and geometrically
        - e. identifies functions and their graphs
    - 4. ***Listening:*** *Receives, attends to, interprets, and responds to verbal messages and other cues*
        - a. listens to lectures and takes notes
        - b. listens to instructions for homework, laboratory, and examination assignments
        - c. listens to questions and responses of students participating in class discussions
        - d. interpret and assimilate video instruction
    - 5. ***Speaking:*** *Organizes ideas and communicates orally*
        - a. participates in classroom discussions
        - b. organize ideas and communicates specific questions to the instructor
- *B.* ***Thinking Skills:*** *Thinks creatively, makes decisions, solves problems, visualizes, knows how to learn and reasons.*
    - 1. ***Creative Thinking:*** *Generates new ideas*
        - a. develops new ideas for approaching problem solving
    - 2. ***Decision Making:*** *Specifies goals and constraints, generates alternatives, considers risks, and evaluates and chooses best alternative*
        - a. selects specific math applications
        - b. selects approach necessary to solve math problems
    - 3. ***Problem Solving:*** *Recognizes problems and devises and implements plan of action*
        - a. solves mathematical problems using an organized step-by-step approach
    - 4. ***Seeing Things In the Mind's Eye:*** *Organizes, and processes symbols, pictures, graphs, objects, and other information*
        - a. prepares sketches, graphs, and tables to assist in understanding word problems
        - b. interprets word problems
        - c. assimilates arithmetic problems in class
        - d. interprets non-verbal communication in the classroom

- e. understands both written and verbal instructions

5. ***Knowing How to Learn:*** *Use efficient learning techniques to acquire and apply new knowledge and skills*
    - a. recognizes relevant information to solve specific problem(s)
    - b. identifies "given" data and applies appropriate equations
    - c. demonstrates mastery of basic math skills
    - d. uses sequential math skills to support mastery of new skills
    - e. thinks through the problem mentally before selecting appropriate formula(e) and equation(s)
    - f. uses previously acquired knowledge to assist in learning new concepts
6. ***Reasoning:*** *Discovers a rule or principle underlying the relationship between two or more objects and applies it when solving a problem*
    - a. selects appropriate mathematical application after considering all given data
    - b. understands and applies the concepts and applications of theorems and algebraic rules
    - c. builds functions and equations describing the relationship between two or more quantities

C. ***Personal Qualities:*** *Displays responsibility, self-esteem, sociability, self-management, and integrity and honesty.*

1. ***Responsibility:*** *Exerts a high level of effort and perseveres toward goal attainment*
    - a. develops an understanding that in order to be successful you must be a "good" student
    - b. develops an understanding that a "good" student is the one who is prompt to every class and has prepared for the day's work
    - c. develops an understanding good students know what they are going to do in class and does not waste time
    - d. develops a fine work ethic
2. ***Self-Esteem:*** *Believes in own self-worth and maintains a positive view of self*
    - a. learns to take pride in his or her work through positive reinforcement
    - b. sees himself or herself as an asset to the class through continued contributions to the group and a shared common goal
    - c. understands that an individual with a positive attitude and the belief in their own abilities will systematically seek solutions and be a valuable employee
3. ***Sociability:*** *Demonstrates understanding, friendliness, adaptability, empathy, and politeness in group settings*
    - a. assist classmates in improving technical skills
    - b. assist students with special needs as a peer mentor
    - c. discusses and demonstrates strategies for effective communication across cultures
4. ***Self-Management:*** *Assesses self accurately, sets personal goals, monitors progress, and exhibits self-control*
    - a. assesses self/personal goals and monitors individual progress

- b. maintain a record of academic achievement (individual grade book)
- c. performs goal setting activities

5. Integrity/Honesty: Chooses ethical courses of action

- a. accepts the responsibility for own actions
- b. exhibit personal honesty at all times
- c. accept the challenge of doing your own work in the laboratory, during examinations, and on outside assignments
- d. understands the consequences of unethical behavior

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MAST

COURSE SYLLABUS

MECHANICS, HEAT AND SOUND

MAST PROGRAM
COURSE SYLLABUS
MECHANICS, HEAT AND SOUND

Lecture hours/week: 3 **Lab hours/week: 3** **Credit hours: 4**

COURSE DESCRIPTION:

This general college physics course for liberal arts or science majors covers motion, momentum, work, power, energy, fields, heat and forces.

PREREQUISITES: **Intermediate Algebra or 2 Years High School Algebra**

REQUIRED COURSE MATERIALS:

Textbook: College Physics, Serway & Faughn, 4th Edition, Saunders Publishing

Supplies: None

METHODS OF INSTRUCTION:

Lecture: Didactic presentations will include lectures and instructor demonstrations.

Laboratory: Laboratory will be "hands-on" activities.

Method of Evaluation: A student's grade will be based on multiple measures of performance. The assessment will measure development of independent critical thinking skills and will include evaluation of the student's ability to:

1. perform the manipulative skills of the craft as required to satisfactorily complete assignments
2. apply theory to assignments
3. perform on written, oral, or practical examinations
4. perform on outside assignments, including writing assignments
5. contribute to class discussions
6. maintain attendance per current policy
7. follow all rules and safety regulations as stated in the manual

LECTURE OUTLINE:

Lecture Topics	Text Reference Page	Contact Hrs.
Introduction, Measurement, Units, Mathematics		3
Motion in One Dimension		6
Vectors and Two Dimensional		

Motion		3
The Laws of Motion		6
Work and Energy		6
Momentum and Collisions		3
Circular Motion and the Laws of Gravity		3
Rational Equilibrium and Rotational Dynamics		3
Solids and Fluids		3
Thermal Physics		6
Heat		3
Laws of Thermodynamics		3
	Total Lecture Hours	**48**

LAB OUTLINE:

Lab Topics		Contact Hrs.
Metric Measurement, Trig Review, Density		3
Free Fall		3
Force Vectors		3
Projectile Motion		3
2nd Law		6
Horsepower		3
Ballistics Pendulum		3
Collisions		3
Rotational Dynamics		3
Torque		3
Archemede's Principle		3
Linear Expansion		6
Calorimetry		3
Review		3
	Total Lab Hours	**48**

COURSE OBJECTIVES: TECHNICAL COMPETENCIES

After the successful completion of this course the student will be able to:

A. **APPLY MATHEMATICAL CONCEPTS**
  1. Perform Basic Arithmetic Operations
    a. Add, subtract, multiply and divide real numbers
    b. Add, subtract, multiply and divide fractions
    c. Convert real numbers to fractional equivalents and vice versa
  2. Compute Unit Conversions
    a. Convert English units to metric units and vice versa
    b. Calculate unit conversion ratios
  3. Perform Basic Trigonometric Operations
    a. Use trigonometric functions to calculate angles
    b. Use trigonometric functions to calculate linear distances

4. Use Cartesian Coordinate System
    a. Plot absolute coordinate data
    b. Plot relative coordinate data
5. Use Polar Coordinate System
    a. Plot absolute coordinate data
    b. Plot relative coordinate data

COURSE OBJECTIVES: SCANS COMPETENCIES

The Secretary's Commission on Achieving Necessary Skills (SCANS), U. S. Department of Labor, has identified in its "AMERICA 2000 REPORT" that all students should develop a new set of competencies and foundation skills if they are to enjoy a productive, full and satisfying life. These are in addition to the Technical Workplace Competencies required by industry. SCANS is made up of five competencies and a three-part foundation of skills and personal qualities that are needed for solid job performance.

The following activities will be performed by each student for successful completion of this course:

I. COMPETENCIES

- *A.* ***Resources:*** *Identifies, organizes, plans, and allocates resources*
    1. follows a schedule to complete assigned tasks on time
    2. make efficient use of physics resources
    3. plans study time to complete assignments and write lab reports
    4. make efficient use of lab time
- *B.* ***Interpersonal:*** *Works with others*
    1. works well with all members of class
- *C.* ***Information:*** *Acquires and uses information*
    1. read and understand physics assignment
    2. organize and apply lab resources
    3. uses critical thinking skills in evaluating physics problems
    4. selects and analyzes information and communicates results using written and graphic methods
- *D.* ***Technology:*** *Works with a variety of technologies*
    1. selects proper measuring devices according to lab requirements
    2. uses measuring devices to investigate and record lab data

II. FOUNDATION SKILLS

- *A.* ***Basic Skills:*** *Reads, writes, performs arithmetic and mathematical operations, listens and speaks.*
    1. ***Reading:*** *Locates, understands, and interprets written information in prose and in documents such as manuals, graphs, and schedules*
        a. reads and studies textbook and lab manual
        b. interprets reading and lab assignments

2. *Writing: Communicates thoughts, ideas, information, and messages in writing and creates documents such as letters, directions, manuals, reports, graphs, and flow charts*
    a. write lecture notes
    b. submit written responses to assigned questions
    c. use proper physics terminology
    d. submit lab report
    e. record lab data
3. *Arithmetic/Mathematics: Perform basic computations and approaches practical problems by choosing appropriately from a variety of mathematical techniques*
    a. apply problem-solving techniques to solve physics problems
    b. evaluate the assumptions and results of a solution in terms of realistic expectations and experimental agreement
4. *Listening: Receives, attends to, interprets, and responds to verbal messages and other cues*
    a. assimilate classroom instruction
    b. interpret and assimilate video instruction
5. *Speaking: Organizes ideas and communicates orally*
    a. participates in classroom discussions
    b. organize ideas and communicate specific questions to the instructor

B. *Thinking Skills: Thinks creatively, makes decisions, solves problems, visualizes, knows how to learn and reasons.*

1. *Creative Thinking: Generates new ideas*
    a. develops new ideas for solving problems
    b. participates in group problem-solving
2. *Decision Making: Specifies goals and constraints, generates alternatives, considers risks, and evaluates and chooses best alternative*
    a. specifies solution procedure to solve assigned problems
    b. specifies experiment procedure to complete lab assignment
    c. select object viewing orientation
    d. select dimensioning layout
3. *Problem Solving: Recognizes problems and devises and implements plan of action*
    a. answer assigned questions
    b. completes lab experiments
    c. selects appropriate solution path
    d. selects appropriate mathematical equation to solve physics problems
4. *Seeing Things In the Mind's Eye: Organizes, and processes symbols, pictures, graphs, objects, and other information*
    a. interpret graphical representation
    b. understand written and oral instructions
5. *Knowing How to Learn: Use efficient learning techniques to acquire and apply new knowledge and skills*
    a. demonstrate mastery of problem solving techniques
    b. use previously learned problem solving skills to support new problem solving skills

6. ***Reasoning:*** *Discovers a rule or principle underlying the relationship between two or more objects and applies it when solving a problem*
    a. performs critical thinking while solving physics problems

C. ***Personal Qualities:*** *Displays responsibility, self-esteem, sociability, self-management, and integrity and honesty.*

1. ***Responsibility:*** *Exerts a high level of effort and perseveres toward goal attainment*
    a. develops an understanding that in order to be successful you must be a "good" student
    b. develops an understanding that a "good" student is the one who is prompt to every class and has prepared for the day's work
    c. develops an understanding good students know what they are going to do in class and does not waste time
    d. develops a fine work ethic
2. ***Self-Esteem:*** *Believes in own self-worth and maintains a positive view of self*
    a. learns to take pride in his or her work through positive reinforcement
    b. sees himself or herself as an asset to the class through continued contributions to the group and a shared common goal
    c. understands that an individual with a positive attitude and the belief in their own abilities will systematically seek solutions and be a valuable employee
3. ***Sociability:*** *Demonstrates understanding, friendliness, adaptability, empathy, and politeness in group settings*
    a. assist classmates in improving technical skills
    b. assist students with special needs as a peer mentor
    c. discusses and demonstrates strategies for effective communication across cultures
4. ***Self-Management:*** *Assesses self accurately, sets personal goals, monitors progress, and exhibits self-control*
    a. assesses self/personal goals and monitors individual progress
    b. maintain a record of academic achievement (individual grade book)
    c. performs goal setting activities
5. ***Integrity/Honesty:*** *Chooses ethical courses of action*
    a. accepts the responsibility for own actions
    b. exhibit personal honesty at all times
    c. accept the challenge of doing your own work in the laboratory, during examinations, and on outside assignments
    d. understands the consequences of unethical behavior

Appropriate Reference Materials:

1. Schaum's Outline in Physics, 8th Edition

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MAST

COURSE SYLLABUS

MACHINE DESIGN

MAST PROGRAM
COURSE SYLLABUS
MACHINE DESIGN

Lecture hours/week: 2 **Lab hours/week: 2** **Credit hours: 3**

COURSE DESCRIPTION:

This course covers the basics of machine design including the design process, types of machines and mechanisms, and the application of machine elements in the design. Computer-aided drafting and design applications are discussed and utilized.

PREREQUISITES: **Introduction to Computer Aided Drafting; Machine Elements**

COREQUISITES: **Statics and Strength of Materials**

REQUIRED COURSE MATERIALS:

Textbook: Engineering Drawing and Design, Jensen, C., Helsel, J.D., 5th Edition, Glencoe/McGraw-Hill, 1996

Supplies: 3.5" high density computer disk

METHODS OF INSTRUCTION:

Lecture: Didactic presentations will include lectures and instructor demonstrations.

Laboratory: Laboratory will be "hands-on" activities.

Method of Evaluation: A student's grade will be based on multiple measures of performance. The assessment will measure development of independent critical thinking skills and will include evaluation of the student's ability to:

1. perform the manipulative skills of the craft as required to satisfactorily complete assignments
2. apply theory to assignments
3. perform on written, oral, or practical examinations
4. perform on outside assignments, including writing assignments
5. contribute to class discussions
6. maintain attendance per current policy
7. follow all rules and safety regulations as stated in the manual

LECTURE OUTLINE:

Lecture Topics	Text Reference Page	Contact Hrs.
Orientation, Engineering Graphs and Charts		2
Conceptual Design		2
Materials Selection		2
Bearings		2
Shaft Design		2
Brakes and Clutches		2
Engineering Cost Analysis		2
Safety in Design		2
Design Project		0
Presentations, Classroom Critique and Discussion		4
	Total Lecture Hours	**20**

LAB OUTLINE:

Lab Topics	Contact Hrs.
Orientation, Engineering Graphs and Charts	2
Conceptual Design	2
Materials Selection	2
Bearings	2
Shaft Design	2
Brakes and Clutches	2
Engineering Cost Analysis	2
Safety in Design	2
Design Project	32
Presentations, Classroom Critique and Discussion	0
Total Lab Hours	**48**

COURSE OBJECTIVES: TECHNICAL COMPETENCIES

After the successful completion of this course the student will be able to:

A. **APPLY MATHEMATICAL CONCEPTS**
  1. Perform Basic Arithmetic Operations
    a. Add, subtract, multiply and divide real numbers
    b. Add, subtract, multiply and divide fractions
    c. Convert real numbers to fractional equivalents and vice versa
  2. Compute Unit Conversions
    a. Convert English units to metric units and vice versa
    b. Calculate unit conversion ratios
  3. Perform Basic Trigonometric Operations
    a. Use trigonometric functions to calculate angles
    b. Use trigonometric functions to calculate linear distances

4. Use Cartesian Coordinate System
    a. Plot absolute coordinate data
    b. Plot relative coordinate data
5. Use Polar Coordinate System
    a. Plot absolute coordinate data
    b. Plot relative coordinate data

B. DEMONSTRATE FUNDAMENTAL DRAFTING SKILLS

1. Use Drawing Media and Related Drafting Materials
    a. Select drawing media
    b. Select related drafting materials (e.g. pencil, triangles, lead,...)
2. Use Measuring Scales
    a. Identify types of scales
    b. Select appropriate scale
    c. Use scales to measure and transfer dimensions
3. Identify Drafting Line Styles and Weights (e.g., center, hidden, object, dimension)
    a. Identify line styles
    b. Apply line styles
4. Prepare Title Blocks and Other Drafting Forms
    a. Identify and prepare title block
    b. Identify and prepare bill of material/parts list
    c. Identify and prepare revision history block
    d. Identify and prepare tolerance block
5. Create Technical Sketches
    a. Identify and create orthographic drawings (single and multi-view)
    b. Identify and create axonometric drawings (iso-, tri- and dimetric)

C. PLAN AND ORGANIZE ACTIVITIES

1. Determine Scope of Drafting Assignment
    a. Understand completion date
    b. Identify number of drawings involved
    c. Identify assignment requirements
    d. Understand drawing responsibilities
2. Select Appropriate Drafting Techniques for Drawings
    a. Identify types of drawings required
    b. Identify types of materials needed
3. Maintain Supporting Documents
    a. Identify supporting documents involved
    b. Understand document filing system
    c. Understand document responsibilities

D. PREPARE MECHANICAL PRODUCTION DRAWINGS

1. Understand and Apply Mechanical Drawing Methods
    a. Understand and apply multi-view orthographic projection
    b. Understand and apply section views
    c. Understand and apply auxiliary views
2. Create Detail Drawings
    a. Understand and apply detail drawing methods
    b. Identify types of detail drawings

    c. Understand layout of detail drawings
    d. Identify individual parts for detailing
    e. Understand role of the manufacturing process in the detail drawings
    f. Identify part dimensions from drawings
3. Create Assembly Drawings
    a. Identify types of assembly drawings
    b. Understand and apply appropriate assembly drawing layout
    c. Understand and apply assembly drawing practices
4. Perform Technical Lettering
    a. Understand technical lettering styles
    b. Identify and apply technical lettering styles
    c. Identify and apply standard notations
5. Create Bill of Material/Parts List
    a. Identify components included in bill of material/parts list
    b. Identify commercially available components in assembly
    c. Identify non-commercially available custom components in assembly
    d. Understand format of a bill of material/parts list
6. Apply Dimensions and Notes
    a. Identify dimensioning systems
    b. Understand and apply current dimensioning standards
    c. Understand dimensioning terminology
    d. Understand and apply detail dimensioning practices
    e. Understand and apply assembly dimensioning practices
7. Apply Dimensional Limits and Tolerances
    a. Understand tolerancing procedures
    b. Identify types of tolerances
    c. Apply tolerances to features
    d. Compute tolerance ranges
    e. Understand inch fit system
    f. Understand metric fit system
    g. Apply fit specifications to features
    h. Compute fits from tabular data and vice versa
    i. Identify types of fits
8. Apply Current Drafting Standards to Drawings
    a. Understand relevant standards
    b. Identify sources of standards
    c. Reference standards
    d. Apply relevant standards
9. Perform Drawing Revisions
    a. Understand reason for revisions
    b. Apply revision notations
    c. Complete revision documentation
10. Use Commercial and Vendor Data
    a. Understand commercial supplier catalogs
    b. Understand vendor drawings

E. ASSIST ENGINEERING PERSONNEL

1. Understand Basic Design Procedures
    - a. Identify design process
    - b. Discuss application of design methods
2. Utilize Fasteners (e.g. screws, bolts, nuts, seals, springs,...) for Mechanical Applications
    - a. Select appropriate fasteners and springs for application
    - b. Understand basic fastener and spring analysis
    - c. Identify types of fasteners and springs
    - d. Use supplier catalogs and standard references to select fasteners and springs for mechanical application
3. Utilize Power Transmission Elements (e.g. gears, cams, belts, chains, couplings, linkages,...) for mechanical applications
    - a. Select appropriate power transmission elements for application
    - b. Understand basic power transmission element analysis
    - c. Identify types of power transmission elements
    - d. Use supplier catalogs and standard references to select power transmission elements for mechanical application
4. Utilize Bearings for Mechanical Applications
    - a. Identify types of bearing devices
    - b. Understand basic bearing device analysis
    - c. Select appropriate bearing devices for applications
    - d. Use supplier catalogs and standard references to select bearing devices for mechanical applications
5. Understand Basic Manufacturing Methods
    - a. Identify types of manufacturing operation
    - b. Understand application of manufacturing in drafting and design of machinery
    - c. Prepare drawing for manufacturing application (e.g. casting drawings, forging drawings,...)
6. Utilize Brakes and Clutches for Mechanical Applications
    - a. Identify types of brakes and clutches
    - b. Understand basic brake and clutch analysis
    - c. Select appropriate brakes and clutches for application
    - d. Use brakes and clutches
7. Design Shafts for Use in Mechanical Applications
    - a. Understand basic shaft analysis
    - b. Select appropriate shafts for applications
    - c. Use design shafts

COURSE OBJECTIVES: SCANS COMPETENCIES

The Secretary's Commission on Achieving Necessary Skills (SCANS), U. S. Department of Labor, has identified in its "AMERICA 2000 REPORT" that all students should develop a new set of competencies and foundation skills if they are to enjoy a productive, full and satisfying life. These are in addition to the Technical Workplace Competencies required by industry.

SCANS is made up of five competencies and a three-part foundation of skills and personal qualities that are needed for solid job performance.

The following activities will be performed by each student for successful completion of this course:

I. **COMPETENCIES**
  A. *Resources: Identifies, organizes, plans, and allocates resources*
    1. follows a schedule to complete assigned tasks on time
    2. make efficient use of resources such as handbooks, textbooks and periodicals
  B. ***Interpersonal:** Works with others*
    1. works well with all members of class
  C. ***Information:** Acquires and uses information*
    1. read and understand assignments
    2. organize and apply resources
    3. read and interpret engineering practices and standards
    4. use computer-aided design program to complete drafting assignment
  D. *Systems: Understands complex inter-relationships*
    1. understand the engineering design drafting system of drawing and designing
    2. anticipates and corrects design situations
    3. design machines and mechanisms
  E. *Technology: Works with a variety of technologies*
    1. chooses CAD application and setting to complete assignment
    2. understand CAD set-up and customization

II. **FOUNDATION SKILLS**
  A. ***Basic Skills:** Reads, writes, performs arithmetic and mathematical operations, listens and speaks.*
    1. ***Reading:** Locates, understands, and interprets written information in prose and in documents such as manuals, graphs, and schedules*
      a. reads and studies textbook
      b. reads catalogs and reference sources
    2. ***Writing:** Communicates thoughts, ideas, information, and messages in writing and creates documents such as letters, directions, manuals, reports, graphs, and flow charts*
      a. write lecture notes
      b. submit written responses to assigned questions
      c. use proper engineering terminology
    3. ***Arithmetic/Mathematics:** Perform basic computations and approaches practical problems by choosing appropriately from a variety of mathematical techniques*
      a. convert units from metric to English and English to metric
      b. multiply, divide, add and subtract real numbers

        c. apply algebraic technique to solve simultaneous equations
        d. use trigonometric and geometric principles to solve for unknown quantities
    4. ***Listening:** Receives, attends to, interprets, and responds to verbal messages and other cues*
        a. assimilate classroom instruction
        b. interpret and assimilate video instruction
    5. ***Speaking:** Organizes ideas and communicates orally*
        a. participates in classroom discussions
        b. organize ideas and communicate specific questions to the instructor
        c. makes presentations to group describing design procedures

B. ***Thinking Skills:** Thinks creatively, makes decisions, solves problems, visualizes, knows how to learn and reasons.*
    1. ***Creative Thinking**: Generates new ideas*
        a. generates feasible designs of machine or mechanisms
    2. ***Decision Making:** Specifies goals and constraints, generates alternatives, considers risks, and evaluates and chooses best alternative*
        a. considers constraints of design
        b. generates alternative approaches to design
        c. evaluates design alternatives
        d. selects best design of a machine or mechanism
    3. ***Problem Solving:** Recognizes problems and devises and implements plan of action*
        a. answer assigned questions
        b. recognize design limitations
        c. generates alternatives to design
        d. develops ideas for new or alternative designs
        e. develops design methods to achieve desired outcome
    4. ***Seeing Things In the Mind's Eye:** Organizes, and processes symbols, pictures, graphs, objects, and other information*
        a. interpret engineering drawings
        b. interpret technical illustrations and symbols
        c. understand written and oral instructions
    5. ***Knowing How to Learn:** Use efficient learning techniques to acquire and apply new knowledge and skills*
        a. demonstrate mastery of basic skills and techniques
        b. use previously learned skills to support new skills
    6. ***Reasoning:** Discovers a rule or principle underlying the relationship between two or more objects and applies it when solving a problem*
        a. understand application of physical laws to design problems
        b. develops practical design solutions

C. ***Personal Qualities:** Displays responsibility, self-esteem, sociability, self-management, and integrity and honesty.*
    1. ***Responsibility:** Exerts a high level of effort and perseveres toward goal attainment*

- a. develops an understanding that in order to be successful you must be a "good" student
- b. develops an understanding that a "good" student is the one who is prompt to every class and has prepared for the day's work
- c. develops an understanding good students know what they are going to do in class and does not waste time
- d. develops a fine work ethic

2. ***Self-Esteem:** Believes in own self-worth and maintains a positive view of self*
    - a. learns to take pride in his or her work through positive reinforcement
    - b. sees himself or herself as an asset to the class through continued contributions to the group and a shared common goal
    - c. understands that an individual with a positive attitude and the belief in their own abilities will systematically seek solutions and be a valuable employee
3. ***Sociability:** Demonstrates understanding, friendliness, adaptability, empathy, and politeness in group settings*
    - a. assist classmates in improving technical skills
    - b. assist students with special needs as a peer mentor
    - c. discusses and demonstrates strategies for effective communication across cultures
4. ***Self-Management:** Assesses self accurately, sets personal goals, monitors progress, and exhibits self-control*
    - a. assesses self/personal goals and monitors individual progress
    - b. maintain a record of academic achievement (individual grade book)
    - c. performs goal setting activities
5. ***Integrity/Honesty:** Chooses ethical courses of action*
    - a. accepts the responsibility for own actions
    - b. exhibit personal honesty at all times
    - c. accept the challenge of doing your own work in the laboratory, during examinations, and on outside assignments
    - d. understands the consequences of unethical behavior

Appropriate Reference Materials:

1. Technical Drawing, Goetsch, D. L., Nelson, J.A., Chalk, W.S., 3rd Edition, Delmar Publishers, 1994
2. Technical Drawing, Giesecke, F.E., et al., 9th Edition, Macmillan, 1991
4. Machinery's Handbook, Oberg, E., et al.,, 24th Edition, Industrial Press, Inc., 1992

*M*achine Tool *A*dvanced *S*kills
*T*echnology Program
MAST

COURSE SYLLABUS

STATICS AND STRENGTH OF MATERIALS

MAST PROGRAM
COURSE SYLLABUS
STATICS AND STRENGTH OF MATERIALS

Lecture hours/week: 1 **Lab hours/week: 4** **Credit hours: 3**

COURSE DESCRIPTION:

Introduces statics and the study of internal stresses in machine members. The student will perform equilibrium calculations for loaded beams, columns, and machine structures, an analysis of time and strength of bolted and riveted joints, and pressure vessels. Moments of inertia, center of gravity and centroids are computed, and static and kinetic friction are discussed. Standard reference tables are used throughout.

PREREQUISITES: **Machine Elements; Trigonometric Functions; Mechanics, Heat and Sound**

REQUIRED COURSE MATERIALS:

Textbook: Statics & Strength of Materials, Bassin, 4th edition, McGraw Hill

Supplies: None

METHODS OF INSTRUCTION:

Lecture: Didactic presentations will include lectures and instructor demonstrations.

Laboratory: Laboratory will be "hands-on" activities.

Method of Evaluation: A student's grade will be based on multiple measures of performance. The assessment will measure development of independent critical thinking skills and will include evaluation of the student's ability to:

1. perform the manipulative skills of the craft as required to satisfactorily complete assignments
2. apply theory to assignments
3. perform on written, oral, or practical examinations
4. perform on outside assignments, including writing assignments
5. contribute to class discussions
6. maintain attendance per current policy
7. follow all rules and safety regulations as stated in the manual

LECTURE OUTLINE:

Lecture Topics	Text Reference Page	Contact Hrs.
Fundamental Terms		1
Resultant & Equilibrium for Forces		1

Moments	1
Non-Concurrent Forces Trusses	1
Static & Kinetic Friction	1
Simple Stresses	1
Properties of Materials	1
Bolted, Riveted Joints & Pressure Vessels	2
Center of Gravity, Moments of Inertia & Centroids	1
Beams & Forces	1
Beam Design	2
Shafts & Torsion	1
Columns	1
Statics Reviews	1
Total Lecture Hours	**16**

LAB OUTLINE:

Lab Topics	Contact Hrs.
Fundamental Terms	4
Resultant & Equilibrium for Forces	4
Moments	4
Non-Concurrent Forces Trusses	4
Static & Kinetic Friction	4
Simple Stresses	4
Properties of Materials	4
Bolted, Riveted Joints & Pressure Vessels	8
Center of Gravity, Moments of Inertia & Centroids	4
Beams & Forces	4
Beam Design	8
Shafts & Torsion	4
Columns	4
Statics Reviews	4
Total Lab Hours	**64**

COURSE OBJECTIVES: TECHNICAL COMPETENCIES

After the successful completion of this course the student will be able to:

A. **APPLY MATHEMATICAL CONCEPTS**
   1. Perform Basic Arithmetic Operations
      a. Add, subtract, multiply and divide real numbers
      b. Add, subtract, multiply and divide fractions
      c. Convert real numbers to fractional equivalents and vice versa
   2. Compute Unit Conversions
      a. Convert English units to metric units and vice versa
      b. Calculate unit conversion ratios
   3. Perform Basic Trigonometric Operations
      a. Use trigonometric functions to calculate angles

        - b. Use trigonometric functions to calculate linear distances
    - 4. Use Cartesian Coordinate System
        - a. Plot absolute coordinate data
        - b. Plot relative coordinate data
    - 5. Use Polar Coordinate System
        - a. Plot absolute coordinate data
        - b. Plot relative coordinate data

B. ASSIST ENGINEERING PERSONNEL

- 1. Design Shafts for Use in Mechanical Applications
    - a. Understand basic shaft analysis
    - b. Select appropriate shafts for applications
    - c. Use design shafts

COURSE OBJECTIVES: SCANS COMPETENCIES

The Secretary's Commission on Achieving Necessary Skills (SCANS), U. S. Department of Labor, has identified in its "AMERICA 2000 REPORT" that all students should develop a new set of competencies and foundation skills if they are to enjoy a productive, full and satisfying life. These are in addition to the Technical Workplace Competencies required by industry. SCANS is made up of five competencies and a three-part foundation of skills and personal qualities that are needed for solid job performance.

The following activities will be performed by each student for successful completion of this course:

I. COMPETENCIES

- *A.* ***Resources:*** *Identifies, organizes, plans, and allocates resources*
    - 1. follows a schedule to complete assigned tasks on time
    - 2. make efficient use of resources such as reference texts, guides and periodicals
- *B.* ***Interpersonal:*** *Works with others*
    - 1. works well with all members of class
- *C.* ***Information:*** *Acquires and uses information*
    - 1. read and understand assignment
    - 2. organize and apply resources
    - 3. read and interpret problem-solving practices and standards
- *D.* ***Systems:*** *Understand complex inter-relationships*
    - 1. understands relationship between material properties and structural strength
    - 2. corrects structural deficiencies based on analysis
    - 3. improves structural designs based on analysis

II. FOUNDATION SKILLS

- *A.* ***Basic Skills:*** *Reads, writes, performs arithmetic and mathematical operations, listens and speaks.*

1. ***Reading:*** *Locates, understands, and interprets written information in prose and in documents such as manuals, graphs, and schedules*
   a. reads and studies textbook
   b. reads reference sources
2. ***Writing:*** *Communicates thoughts, ideas, information, and messages in writing and creates documents such as letters, directions, manuals, reports, graphs, and flow charts*
   a. write lecture notes
   b. submit written responses to assigned questions
   c. use proper engineering terminology
3. ***Arithmetic/Mathematics:*** *Perform basic computations and approaches practical problems by choosing appropriately from a variety of mathematical techniques*
   a. compute forces and moments on structures
   b. compute moments of inertia and centroids
   c. convert from English to metric and vice versa
   d. use mathematical formulae to compute stresses, strains and deflections
4. ***Listening:*** *Receives, attends to, interprets, and responds to verbal messages and other cues*
   a. assimilate classroom instruction
   b. interpret and assimilate video instruction
5. ***Speaking:*** *Organizes ideas and communicates orally*
   a. participates in classroom discussions
   b. organize ideas and communicate specific questions to the instructor

B. ***Thinking Skills:*** *Thinks creatively, makes decisions, solves problems, visualizes, knows how to learn and reasons.*

1. ***Creative Thinking:*** *Generates new ideas*
   a. develop new ideas for approaching problem solving
2. ***Decision Making:*** *Specifies goals and constraints, generates alternatives, considers risks, and evaluates and chooses best alternative*
   a. chooses efficient solution procedure for assigned problems
3. ***Problem Solving:*** *Recognizes problems and devises and implements plan of action*
   a. find solutions to problems using planned analysis
4. ***Seeing Things In the Mind's Eye:*** *Organizes, and processes symbols, pictures, graphs, objects, and other information*
   a. interpret engineering diagrams
   b. interpret technical illustrations and symbols
   c. understand written and oral instructions
5. ***Knowing How to Learn:*** *Use efficient learning techniques to acquire and apply new knowledge and skills*
   a. demonstrate mastery of basic skills and techniques
   b. use previously learned skills to support new skills
6. ***Reasoning:*** *Discovers a rule or principle underlying the relationship between two or more objects and applies it when solving a problem*
   a. understands physical basis for statics and strength equations
   b. applies knowledge to solution of real-world problems

C. ***Personal Qualities:*** *Displays responsibility, self-esteem, sociability, self-management, and integrity and honesty.*

1. ***Responsibility:*** *Exerts a high level of effort and perseveres toward goal attainment*
    a. develops an understanding that in order to be successful you must be a "good" student
    b. develops an understanding that a "good" student is the one who is prompt to every class and has prepared for the day's work
    c. develops an understanding good students know what they are going to do in class and does not waste time
    d. develops a fine work ethic
2. ***Self-Esteem:*** *Believes in own self-worth and maintains a positive view of self*
    a. learns to take pride in his or her work through positive reinforcement
    b. sees himself or herself as an asset to the class through continued contributions to the group and a shared common goal
    c. understands that an individual with a positive attitude and the belief in their own abilities will systematically seek solutions and be a valuable employee
3. ***Sociability:*** *Demonstrates understanding, friendliness, adaptability, empathy, and politeness in group settings*
    a. assist classmates in improving technical skills
    b. assist students with special needs as a peer mentor
    c. discusses and demonstrates strategies for effective communication across cultures
4. ***Self-Management:*** *Assesses self accurately, sets personal goals, monitors progress, and exhibits self-control*
    a. assesses self/personal goals and monitors individual progress
    b. maintain a record of academic achievement (individual grade book)
    c. performs goal setting activities
5. ***Integrity/Honesty:*** *Chooses ethical courses of action*
    a. accepts the responsibility for own actions
    b. exhibit personal honesty at all times
    c. accept the challenge of doing your own work in the laboratory, during examinations, and on outside assignments
    d. understands the consequences of unethical behavior

*M*achine Tool *A*dvanced *S*kills
*T*echnology Program

MAST

COURSE SYLLABUS

PLANT ENGINEERING DRAFTING

MAST PROGRAM
COURSE SYLLABUS
PLANT ENGINEERING DRAFTING

Lecture hours/week: 1 **Lab hours/week: 4** **Credit hours: 3**

COURSE DESCRIPTION:

Topics include piping layouts, symbols and detailing; electrical drafting of wiring diagrams and schematics; welding drafting (including processes, symbols), structural detailing and materials handling. Covers CAD applications in detail.

PREREQUISITES: **Introduction to Computer Aided Drafting; Tool Drafting; Technical Mathematics**

REQUIRED COURSE MATERIALS:

Textbook: Engineering Drawing and Design, Jensen, C., Helsel, J.D., 5th Edition, Glencoe/Graw-Hill, 1996

Supplies: None

METHODS OF INSTRUCTION:

Lecture: Didactic presentations will include lectures and instructor demonstrations.

Laboratory: Laboratory will be "hands-on" activities.

Method of Evaluation: A student's grade will be based on multiple measures of performance. The assessment will measure development of independent critical thinking skills and will include evaluation of the student's ability to:

1. perform the manipulative skills of the craft as required to satisfactorily complete assignments
2. apply theory to assignments
3. perform on written, oral, or practical examinations
4. perform on outside assignments, including writing assignments
5. contribute to class discussions
6. maintain attendance per current policy
7. follow all rules and safety regulations as stated in the manual

LECTURE OUTLINE:

Lecture Topics	Text Reference Page	Contact Hrs.
Class Orientation, Lab Plant Engineering, CAD Overview		1
Permanent Fasteners		3

Wiring Diagrams	2
Orthographic Piping	1
Pictorial Piping	2
Trusses	1
Structural Detailing	2
Schematic Diagrams	1
Material Handling	3
Total Lecture Hours	**16**

LAB OUTLINE:

Lab Topics	Contact Hrs.
Fasteners	12
Wiring Diagrams	8
Orthographic Piping	4
Pictorial Piping	8
Trusses	4
Structural Detailing	8
Schematic Diagrams	4
Material Handling	12
Total Lab Hours	**60**

COURSE OBJECTIVES: TECHNICAL COMPETENCIES

After the successful completion of this course the student will be able to:

A. **APPLY MATHEMATICAL CONCEPTS**
  1. Perform Basic Arithmetic Operations
    a. Add, subtract, multiply and divide real numbers
    b. Add, subtract, multiply and divide fractions
    c. Convert real numbers to fractional equivalents and vice versa
  2. Compute Unit Conversions
    a. Convert English units to metric units and vice versa
    b. Plot absolute coordinate data
    c. Plot relative coordinate data
  3. Use Polar Coordinate System
    a. Plot absolute coordinate data
    b. Plot relative coordinate data

B. **DEMONSTRATE FUNDAMENTAL DRAFTING SKILLS**
  1. Use Drawing Media and Related Drafting Materials
    a. Select drawing media
    b. Select related drafting materials (e.g. pencil, triangles, lead,...)
  2. Use Measuring Scales
    a. Identify types of scales
    b. Select appropriate scale
    c. Use scales to measure and transfer dimensions
  3. Identify Drafting Line Styles and Weights (e.g., center, hidden, object, dimension)
    a. Identify line styles

    - b. Apply line styles
- 4. Prepare Title Blocks and Other Drafting Forms
    - a. Identify and prepare title block
- 5. Create Technical Sketches
    - a. Identify and create orthographic drawings (single and multi-view)
    - b. Identify and create axonometric drawings (iso-, tri- and dimetric)

C. PLAN AND ORGANIZE ACTIVITIES

- 1. Determine Scope of Drafting Assignment
    - a. Understand completion date
    - b. Identify number of drawings involved
    - c. Identify assignment requirements
    - d. Understand drawing responsibilities
- 2. Select Appropriate Drafting Techniques for Drawings
    - a. Identify types of drawings required
    - b. Identify types of materials needed
- 3. Maintain Supporting Documents
    - a. Identify supporting documents involved
    - b. Understand document filing system
    - c. Understand document responsibilities

D. PREPARE MECHANICAL PRODUCTION DRAWINGS

- 1. Understand and Apply Mechanical Drawing Methods
    - a. Understand and apply multi-view orthographic projection
    - b. Understand and apply section views
    - c. Understand and apply auxiliary views
- 2. Perform Technical Lettering
    - a. Understand technical lettering styles
    - b. Identify and apply technical lettering styles
    - c. Identify and apply standard notations
- 3. Create Bill of Material/Parts List
    - a. Identify commercially available components in assembly
    - b. Identify non-commercially available custom components in assembly
    - c. Understand format of a bill of material/parts list
- 4. Apply Dimensions and Notes
    - a. Identify dimensioning systems
    - b. Understand and apply current dimensioning standards
    - c. Understand dimensioning terminology
    - d. Understand and apply detail dimensioning practices
    - e. Understand and apply assembly dimensioning practices
- 5. Apply Dimensional Limits and Tolerances
    - a. Understand tolerancing procedures
    - b. Identify types of tolerances
    - c. Apply tolerances to features
    - d. Compute tolerance ranges
    - e. Understand inch fit system
    - f. Understand metric fit system
    - g. Apply fit specifications to features
    - h. Compute fits from tabular data and vice versa
    - i. Identify types of fits

6. Apply Current Drafting Standards to Drawings
    a. Understand relevant standards
    b. Identify sources of standards
    c. Reference standards
    d. Apply relevant standards
7. Perform Drawing Revisions
    a. Understand reason for revisions
    b. Apply revision notations
    c. Complete revision documentation
8. Use Commercial and Vendor Data
    a. Understand commercial supplier catalogs
    b. Understand vendor drawings

E. ASSIST ENGINEERING PERSONNEL

1. Utilize Fasteners (e.g. screws, bolts, nuts, seals, springs,...) for Mechanical Applications
    a. Select appropriate fasteners and springs for application
    b. Understand basic fastener and spring analysis
    c. Identify types of fasteners and springs
    d. Use supplier catalogs and standard references to select fasteners and springs for mechanical application

F. USE COMPUTER-AIDED DRAFTING SYSTEM

1. Start and exit a software program
    a. Understand starting procedures
    b. Understand exiting procedures
2. Demonstrate Proper File Management Techniques
    a. Explain file management techniques
    b. Demonstrate file management procedures
    c. Format a floppy disk
3. Use Directory Structure
    a. Identify directories and sub-directories
    b. Create and delete directories
4. Edit Drawing File
    a. Create new drawing file
    b. Open existing drawing file
5. Utilize Drawing Set-Up Procedures
    a. Identify drawing set-up parameters
    b. Perform drawing set-up
6. Use Geometric Objects (e.g. lines, splines, circles,...)
    a. Construct objects
    b. Edit objects
    c. Manipulate objects
7. Use Text for Drawing Annotation
    a. Create text annotation
    b. Edit text
8. Control Object Properties (color, line-type,...)
    a. Determine object property
    b. Modify object property
9. Use Viewing/Display Commands

    a. Demonstrate view commands
10. Use Standard Parts and/or Symbol Libraries
    a. Create parts/symbols
    b. Create symbol libraries
    c. Use standard parts/symbol libraries
11. Understand Procedure to Print/Plot a Drawing
    a. Demonstrate plotting procedures
    b. Determine scaling and layout
    c. Use various printers and plotters
12. Use Standard Layering Techniques
    a. Define standard layering procedures
    b. Apply standard layering techniques
13. Create Mechanical CAD Drawings
    a. Use CAD to create multi-view orthographic drawings
    b. Understand 2-D multi-view drawing procedures on CAD system
14. Use CAD Dimensioning Features
    a. Identify dimensioning variables
    b. Set dimensioning variables
    c. Use dimension drawings using CAD
    d. Use dimensioning standards with CAD
    e. Modify CAD dimensions
15. Use Third-Party Software for CAD Enhancement
    a. Identify third-party software
    b. Use third-party software
16. Perform CAD Customization Procedures
    a. Identify customization techniques and procedures
    b. Use customization techniques and procedures

COURSE OBJECTIVES: SCANS COMPETENCIES

The Secretary's Commission on Achieving Necessary Skills (SCANS), U. S. Department of Labor, has identified in its "AMERICA 2000 REPORT" that all students should develop a new set of competencies and foundation skills if they are to enjoy a productive, full and satisfying life. These are in addition to the Technical Workplace Competencies required by industry. SCANS is made up of five competencies and a three-part foundation of skills and personal qualities that are needed for solid job performance.

The following activities will be performed by each student for successful completion of this course:

I. COMPETENCIES

A. ***Resources:** Identifies, organizes, plans, and allocates resources*
    1. follows a schedule to complete assigned tasks on time
    2. make efficient use of drafting resources such as paper, leads and ink
B. ***Interpersonal:** Works with others*
    1. works well with all members of class

- C. *Information: Acquires and uses information*
  1. read and understand drafting assignment
  2. organize and apply drafting resources
  3. read and interpret drafting practices and standards
  4. use computer-aided design program to complete drafting assignment
- *D. Systems: Understands complex inter-relationships*
  1. understand the engineering design drafting system of drawing and designing
- *E. Technology: Works with a variety of technologies*
  1. chooses CAD application and setting to complete drafting assignment
  2. understand CAD set-up and customization

II. **FOUNDATION SKILLS**

- *A.* ***Basic Skills:*** *Reads, writes, performs arithmetic and mathematical operations, listens and speaks.*
  - *1.* ***Reading:*** *Locates, understands, and interprets written information in prose and in documents such as manuals, graphs, and schedules*
    - a. reads and studies textbook
    - b. reads catalogs and reference sources
  - *2.* ***Writing:*** *Communicates thoughts, ideas, information, and messages in writing and creates documents such as letters, directions, manuals, reports, graphs, and flow charts*
    - a. write lecture notes
    - b. submit written responses to assigned questions
    - c. use proper engineering drafting terminology
  - *3.* ***Arithmetic/Mathematics:*** *Perform basic computations and approaches practical problems by choosing appropriately from a variety of mathematical techniques*
    - a. calculate proper drawing spacing
    - b. convert linear measurements from metric to English and English to metric
    - c. scale drawing
    - d. convert fractions to decimals
    - e. compute piping specifications
  - *4.* ***Listening:*** *Receives, attends to, interprets, and responds to verbal messages and other cues*
    - a. assimilate classroom instruction
    - b. interpret and assimilate video instruction
  - *5.* ***Speaking:*** *Organizes ideas and communicates orally*
    - a. participates in classroom discussions
    - b. organize ideas and communicate specific questions to the instructor
- *B.* ***Thinking Skills:*** *Thinks creatively, makes decisions, solves problems, visualizes, knows how to learn and reasons.*
  - *1.* ***Decision Making:*** *Specifies goals and constraints, generates alternatives, considers risks, and evaluates and chooses best alternative*
    - a. consider various orientations for drawings
    - b. select drafting technique
    - c. select object viewing orientation

    - d. select dimensioning layout
    - e. select drawing type
  - 2. ***Problem Solving:*** *Recognizes problems and devises and implements plan of action*
    - a. answer assigned questions
    - b. select types of view to describe object
  - 3. ***Seeing Things In the Mind's Eye:*** *Organizes, and processes symbols, pictures, graphs, objects, and other information*
    - a. interpret engineering drawings
    - b. interpret technical illustrations and symbols
    - c. understand written and oral instructions
  - 4. ***Knowing How to Learn:*** *Use efficient learning techniques to acquire and apply new knowledge and skills*
    - a. demonstrate mastery of basic skills and techniques
    - b. use previously learned skills to support new skills
  - 5. ***Reasoning:*** *Discovers a rule or principle underlying the relationship between two or more objects and applies it when solving a problem*
    - a. understand application of industry standards to design problems
    - b. develops practical design solutions
- *C.* ***Personal Qualities:*** *Displays responsibility, self-esteem, sociability, self-management, and integrity and honesty.*
  - 1. ***Responsibility:*** *Exerts a high level of effort and perseveres toward goal attainment*
    - a. develops an understanding that in order to be successful you must be a "good" student
    - b. develops an understanding that a "good" student is the one who is prompt to every class and has prepared for the day's work
    - c. develops an understanding good students know what they are going to do in class and does not waste time
    - d. develops a fine work ethic
  - 2. ***Self-Esteem:*** *Believes in own self-worth and maintains a positive view of self*
    - a. learns to take pride in his or her work through positive reinforcement
    - b. sees himself or herself as an asset to the class through continued contributions to the group and a shared common goal
    - c. understands that an individual with a positive attitude and the belief in their own abilities will systematically seek solutions and be a valuable employee
  - 3. ***Sociability:*** *Demonstrates understanding, friendliness, adaptability, empathy, and politeness in group settings*
    - a. assist classmates in improving technical skills
    - b. assist students with special needs as a peer mentor
    - c. discusses and demonstrates strategies for effective communication across cultures
  - 4. ***Self-Management:*** *Assesses self accurately, sets personal goals, monitors progress, and exhibits self-control*
    - a. assesses self/personal goals and monitors individual progress

   b. maintain a record of academic achievement (individual grade book)
   c. performs goal setting activities

5. *Integrity/Honesty: Chooses ethical courses of action*
   a. accepts the responsibility for own actions
   b. exhibit personal honesty at all times
   c. accept the challenge of doing your own work in the laboratory, during examinations, and on outside assignments
   d. understands the consequences of unethical behavior

*M*achine Tool *A*dvanced *S*kills
*T*echnology Program

MAST

COURSE SYLLABUS

CAD/CAM CONCEPTS

MAST PROGRAM
COURSE SYLLABUS
CAD/CAM CONCEPTS

Lecture hours/week: 1 **Lab hours/week: 4** **Credit hours: 3**

COURSE DESCRIPTION:

This course covers theory and concepts of using a CAD based system to generate numerical control programs for production machinery. Creation of tool databases, machining curves and tool paths for lathes and mills are discussed. In addition, tool and turret statements and machine characteristics are covered. Machining of parts is not included in this fundamental course.

PREREQUISITES: **Introduction to Computer Aided Drafting; 3-D Modeling and Rendering**

REQUIRED COURSE MATERIALS:

Textbook:	Instructor supplies hand-outs
Supplies:	3.5" high-density disk

METHODS OF INSTRUCTION:

Lecture: Didactic presentations will include lectures and instructor demonstrations.

Laboratory: Laboratory will be "hands-on" activities.

Method of Evaluation: A student's grade will be based on multiple measures of performance. The assessment will measure development of independent critical thinking skills and will include evaluation of the student's ability to:

1. perform the manipulative skills of the craft as required to satisfactorily complete assignments
2. apply theory to assignments
3. perform on written, oral, or practical examinations
4. perform on outside assignments, including writing assignments
5. contribute to class discussions
6. maintain attendance per current policy
7. follow all rules and safety regulations as stated in the manual

LECTURE OUTLINE:

Lecture Topics	Text Reference Page	Contact Hrs.
		—
	Total Lecture Hours	

LAB OUTLINE:

Lab Topics	Contact Hrs.
Total Lab Hours	—

COURSE OBJECTIVES: TECHNICAL COMPETENCIES

After the successful completion of this course the student will be able to:

A. APPLY MATHEMATICAL CONCEPTS

1. Perform Basic Arithmetic Operations
   - a. Add, subtract, multiply and divide real numbers
   - b. Add, subtract, multiply and divide fractions
   - c. Convert real numbers to fractional equivalents and vice versa
2. Compute Unit Conversions
   - a. Convert English units to metric units and vice versa
3. Use Cartesian Coordinate System
   - a. Plot absolute coordinate data
   - b. Plot relative coordinate data
4. Use Polar Coordinate System
   - a. Plot absolute coordinate data
   - b. Plot relative coordinate data

B. DEMONSTRATE FUNDAMENTAL DRAFTING SKILLS

1. Use Drawing Media and Related Drafting Materials
   - a. Select drawing media
   - b. Select related drafting materials (e.g. pencil, triangles, lead,...)
2. Use Measuring Scales
   - a. Identify types of scales
   - b. Select appropriate scale
   - c. Use scales to measure and transfer dimensions
3. Identify Drafting Line Styles and Weights (e.g., center, hidden, object, dimension)
   - a. Identify line styles
   - b. Apply line styles
4. Prepare Title Blocks and Other Drafting Forms
   - a. Identify and prepare title block
   - b. Identify and prepare tolerance block
5. Create Technical Sketches
   - a. Identify and create orthographic drawings (single and multi-view)

C. PLAN AND ORGANIZE ACTIVITIES

1. Determine Scope of Drafting Assignment
   - a. Understand completion date
   - b. Identify number of drawings involved
   - c. Identify assignment requirements
   - d. Understand drawing responsibilities
2. Select Appropriate Drafting Techniques for Drawings
   - a. Identify types of drawings required
   - b. Identify types of materials needed

3. Maintain Supporting Documents
    a. Identify supporting documents involved
    b. Understand document filing system
    c. Understand document responsibilities

D. PREPARE MECHANICAL PRODUCTION DRAWINGS

1. Understand and Apply Mechanical Drawing Methods
    a. Understand and apply multi-view orthographic projection
    b. Understand and apply section views
    c. Understand and apply auxiliary views
2. Create Detail Drawings
    a. Understand and apply detail drawing methods
    b. Identify types of detail drawings
    c. Understand layout of detail drawings
    d. Identify individual parts for detailing
    e. Understand role of the manufacturing process in the detail drawings
    f. Identify part dimensions from drawings
3. Create Assembly Drawings
    a. Identify types of assembly drawings
    b. Understand and apply appropriate assembly drawing layout
    c. Understand and apply assembly drawing practices
4. Perform Technical Lettering
    a. Identify and apply standard notations

E. ASSIST ENGINEERING PERSONNEL

1. Understand Basic Manufacturing Methods
    a. Identify types of manufacturing operation
    b. Understand application of manufacturing in drafting and design of machinery
    c. Prepare drawing for manufacturing application (e.g. casting drawings, forging drawings,...)

F. USE COMPUTER-AIDED DRAFTING SYSTEM

1. Start and exit a software program
    a. Understand starting procedures
    b. Understand exiting procedures
2. Demonstrate Proper File Management Techniques
    a. Explain file management techniques
    b. Demonstrate file management procedures
    c. Format a floppy disk
3. Use Directory Structure
    a. Identify directories and sub-directories
    b. Create and delete directories
4. Edit Drawing File
    a. Create new drawing file
    b. Open existing drawing file
5. Utilize Drawing Set-Up Procedures
    a. Identify drawing set-up parameters
    b. Perform drawing set-up
6. Use Geometric Objects (e.g. lines, splines, circles,...)
    a. Construct objects

    b. Edit objects
    c. Manipulate objects
7. Use Text for Drawing Annotation
    a. Create text annotation
    b. Edit text
8. Control Object Properties (color, line-type,...)
    a. Determine object property
    b. Modify object property
9. Use Viewing/Display Commands
    a. Demonstrate view commands
    b. Create multiple viewing windows
    c. Demonstrate 3D display procedures
10. Use Standard Parts and/or Symbol Libraries
    a. Create parts/symbols
    b. Create symbol libraries
    c. Use standard parts/symbol libraries
11. Understand Procedure to Print/Plot a Drawing
    a. Demonstrate plotting procedures
    b. Determine scaling and layout
    c. Use various printers and plotters
12. Use Standard Layering Techniques
    a. Define standard layering procedures
    b. Apply standard layering techniques
13. Create Mechanical CAD Drawings
    a. Use CAD to create multi-view orthographic drawings
    b. Understand 2-D multi-view drawing procedures on CAD system
14. Create 3D Mechanical Models
    a. Convert 2-D drawing information into 3-D
    b. Create and edit wireframe model
    c. Create and edit 3-D surface model
    d. Create and edit 3-D solid model
15. Utilize CAD Drawing Data
    a. Translate CAD drawings into data file formate (DXF, IGES)
    b. Import data files into CAD drawings
    c. Query CAD data files
16. Obtain 3-D Model Property Data
    a. Identify surface properties (surface, volume)
    b. Extract surface properties
    c. Identify mass properties (mom. of inertia, centroids, center of gravity)
    d. Extract mass properties
17. Use CAD Dimensioning Features
    a. Identify dimensioning variables
    b. Set dimensioning variables
    c. Use dimension drawings using CAD
    d. Use dimensioning standards with CAD
    e. Modify CAD dimensions
18. Use Third-Party Software for CAD Enhancement
    a. Identify third-party software

    b. Use third-party software
19. Perform CAD Customization Procedures
    a. Identify customization techniques and procedures
    b. Use customization techniques and procedures

COURSE OBJECTIVES: SCANS COMPETENCIES

The Secretary's Commission on Achieving Necessary Skills (SCANS), U. S. Department of Labor, has identified in its "AMERICA 2000 REPORT" that all l students should develop a new set of competencies and foundation skills if they are to enjoy a productive, full and satisfying life. These are in addition to the Technical Workplace Competencies required by industry. SCANS is made up of five competencies and a three-part foundation of skills and personal qualities that are needed for solid job performance.

The following activities will be performed by each student for successful completion of this course:

I. COMPETENCIES

- *A.* ***Resources:*** *Identifies, organizes, plans, and allocates resource*
    1. follows a schedule to complete assigned tasks on time
    2. make efficient use of drafting resources such as paper, leads and ink
- *B.* ***Interpersonal:*** *Works with others*
    1. works well with all members of class
- *C.* ***Information:*** *Acquires and uses information*
    1. read and understand drafting assignment
    2. organize and apply drafting resources
    3. read and interpret drafting practices and standards
    4. use computer-aided design program to complete drafting assignment
- *D.* ***Systems:*** *Understands complex inter-relationships*
    1. understand the engineering design drafting system of drawing and designing
    2. understand relationship between CAD, CAM and CNC machining
- *E.* ***Technology:*** *Works with a variety of technologies*
    1. chooses CAD/CAM application and setting to complete assignment
    2. understand CAD/CAM set-up and customization

II. FOUNDATION SKILLS

- *A.* ***Basic Skills:*** *Reads, writes, performs arithmetic and mathematical operations, listens and speaks.*
    - *1.* ***Reading:*** *Locates, understands, and interprets written information in prose and in documents such as manuals, graphs, and schedules*
        - a. reads and studies textbook
        - b. reads manuals and reference sources
    - *2.* ***Writing:*** *Communicates thoughts, ideas, information, and messages in writing and creates documents such as letters, directions, manuals, reports, graphs, and flow charts*

        a. write lecture notes
        b. submit written responses to assigned questions
        c. use proper engineering drafting and machining terminology
    3. ***Arithmetic/Mathematics:*** *Perform basic computations and approaches practical problems by choosing appropriately from a variety of mathematical techniques*
        a. convert linear measurements from metric to English and English to metric
        b. convert fractions to decimals
        c. measure drawn objects
        d. compute machine feeds, speed and axial depths of cut
    4. ***Listening:*** *Receives, attends to, interprets, and responds to verbal messages and other cues*
        a. assimilate classroom instruction
        b. interpret and assimilate video instruction
    5. ***Speaking:*** *Organizes ideas and communicates orally*
        a. participates in classroom discussions
        b. organize ideas and communicate specific questions to the instructor

B. ***Thinking Skills:*** *Thinks creatively, makes decisions, solves problems, visualizes, knows how to learn and reasons.*
    1. ***Decision Making:*** *Specifies goals and constraints, generates alternatives, considers risks, and evaluates and chooses best alternative*
        a. select proper machine tooling
        b. select tool path
    2. ***Problem Solving:*** *Recognizes problems and devises and implements plan of action*
        a. answer assigned questions
    3. ***Seeing Things In the Mind's Eye:*** *Organizes, and processes symbols, pictures, graphs, objects, and other information*
        a. interpret engineering drawings
        b. interpret technical illustrations and symbols
        c. understand written and oral instructions
    4. ***Knowing How to Learn:*** *Use efficient learning techniques to acquire and apply new knowledge and skills*
        a. demonstrate mastery of basic skills and techniques
        b. use previously learned skills to support new skills
    5. ***Reasoning:*** *Discovers a rule or principle underlying the relationship between two or more objects and applies it when solving a problem:*
        a. understand relationship between CAD and CAM

C. ***Personal Qualities:*** *Displays responsibility, self-esteem, sociability, self-management, and integrity and honesty.*
    1. ***Responsibility:*** *Exerts a high level of effort and perseveres toward goal attainment*
        a. develops an understanding that in order to be successful you must be a “good” student
        b. develops an understanding that a “good” student is the one who is prompt to every class and has prepared for the day’s work

   - c. develops an understanding good students know what they are going to do in class and does not waste time
   - d. develops a fine work ethic

2. ***Self-Esteem:** Believes in own self-worth and maintains a positive view of self*
   - a. learns to take pride in his or her work through positive reinforcement
   - b. sees himself or herself as an asset to the class through continued contributions to the group and a shared common goal
   - c. understands that an individual with a positive attitude and the belief in their own abilities will systematically seek solutions and be a valuable employee
3. ***Sociability:** Demonstrates understanding, friendliness, adaptability, empathy, and politeness in group settings*
   - a. assist classmates in improving technical skills
   - b. assist students with special needs as a peer mentor
   - c. discusses and demonstrates strategies for effective communication across cultures
4. ***Self-Management:** Assesses self accurately, sets personal goals, monitors progress, and exhibits self-control*
   - a. assesses self/personal goals and monitors individual progress
   - b. maintain a record of academic achievement (individual grade book)
   - c. performs goal setting activities
5. ***Integrity/Honesty:** Chooses ethical courses of action*
   - a. accepts the responsibility for own actions
   - b. exhibit personal honesty at all times
   - c. accept the challenge of doing your own work in the laboratory, during examinations, and on outside assignments
   - d. understands the consequences of unethical behavior

*M*achine Tool *A*dvanced *S*kills
*T*echnology Program

MAST

COURSE SYLLABUS

SPEECH FUNDAMENTALS

MAST PROGRAM
COURSE SYLLABUS
SPEECH FUNDAMENTALS

Lecture hours/week: 3 **Lab hours/week: 0** **Credit hours: 3**

COURSE DESCRIPTION:

Introduction to basic oral communication principles and skills, challenges of cultural diversity and gender equity. Includes study and practice in public speaking and discussion, preparation and organization, and delivery techniques. This course satisfies the requirements of Public Act 87-581.

PREREQUISITES: **NONE**

REQUIRED COURSE MATERIALS:

Textbook: The Art of Public Speaking, Lucks, Stephen E., 4th edition, Random House, 1992

Supplies: None

METHODS OF INSTRUCTION:

Lecture: Didactic presentations will include lectures and instructor demonstrations.

Method of Evaluation: A student's grade will be based on multiple measures of performance. The assessment will measure development of independent critical thinking skills and will include evaluation of the student's ability to:

1. perform on written, oral, or practical examinations
2. perform on outside assignments, including writing assignments
3. contribute to class discussions
4. maintain attendance per current policy

LECTURE OUTLINE:

Lecture Topics	Text Reference Page	Contact Hrs.
Introduction to Course and Symposium, Discussion	Chapters 1, 2 and 4	
Lecture: The Dynamics of Human Communication		
Class Exercises: Active Listening		
Lecture: Communication	Chapters 10, 11	
Group Meetings in Preparation for Symposium, Discussion		

Lecture: Introduction to Informative Speaking	Chapters 3, 5, 12, 13
Videotape, Symposium, Discussion	
Lecture: Informative Speech Organization	Chapters 6, 7, 8, 9
Informative speeches are due for all students	
Assign vocal variety exercise	
Lecture: Introduction to Persuasive Speaking	Chapters 14, 6, 4
Audience Analysis Exercise	
Lecture: Organizing the Persuasive Speech	Chapter 14
Individual conferences	
Continue discussing persuasive speech: logical, emotional, credibility appeals	
Vocal Variety exercises are due	
Persuasive speeches begin	
Introduction to Special Occasion Speaking	Chapter 15
Group meetings in preparation for Final Exam Review	
Final Exam Review groups are due for all students	
Text: All lecture notes, text should be reviewed	
Special Occasion Speeches are due for all students	
Self evaluations are due for all students	
Final Exam Week	

Total Lecture Hours —

COURSE OBJECTIVES: SCANS COMPETENCIES

The Secretary's Commission on Achieving Necessary Skills (SCANS), U. S. Department of Labor, has identified in its "AMERICA 2000 REPORT" that all l students should develop a new set of competencies and foundation skills if they are to enjoy a productive, full and satisfying life. These are in addition to the Technical Workplace Competencies required by industry. SCANS is made up of five competencies and a three-part foundation of skills and personal qualities that are needed for solid job performance.

The following activities will be performed by each student for successful completion of this course:

I. COMPETENCIES

- *A.* ***Resources:*** *Identifies, organizes, plans, and allocates resources*
  1. follows a schedule to complete assigned tasks on time
  2. provides a self-evaluation of performance based on the time and quality of work
  3. prepares and formulates short reports, memos, and letters
- *B.* ***Interpersonal:*** *Works with others*
  1. participates as a member of a team through class discussions and group projects; works cooperatively with others and contributes to the group process with ideas and suggestions
  2. provides feedback to peers and instructors
  3. works with diversity through interaction with class members of varied ethnic, religious, and social backgrounds
- *C.* ***Information:*** *Acquires and uses information*
  1. acquires and evaluates information through preparing graphs and charts and interpreting these graphs and charts
  2. organizes and maintains information by formulating letters, memos, and short reports; also uses critical thinking skills in making decisions, presenting informative, and demonstration speeches
  3. interprets articles from periodicals, newsletters, etc., relevant to individual student's major and prepares short interpretive reports
  4. uses computers to prepare various required writing assignments
- *D.* ***Systems:*** *Understands complex inter-relationships*
  1. understands systems; performs various tasks in the writing lab using appropriate computer software
  2. demonstrates knowledge and organizational structure and uses the chain of command
  3. monitors and corrects performance during the writing process in the writing lab
- *E.* ***Technology:*** *Works with a variety of technologies*
  1. selects technology; applies computer and writing skills in the writing lab by using appropriate software

II. FOUNDATION SKILLS

- *A.* ***Basic Skills:*** *Reads, writes, performs arithmetic and mathematical operations, listens and speaks.*
  1. ***Reading:*** *Locates, understands, and interprets written information in prose and in documents such as manuals, graphs, and schedules*
     - a. reads and studies textbook and reading assignments
     - b. interprets reading assignments
     - c. locates and interprets written information including graphs, charts and periodical articles
     - d. interprets class schedule
  2. ***Writing:*** *Communicates thoughts, ideas, information, and messages in writing and creates documents such as letters, directions, manuals, reports, graphs, and flow charts*
     - a. completes written assignments, including memos, letters, graphs, and charts

        - b. takes class notes
    - 3. ***Listening:** Receives, attends to, interprets, and responds to verbal messages and other cues*
        - a. receives and interprets lecture materials
        - b. responds to verbal messages
        - c. confirms verbal message interpretations with instructor and peers, both in and out of class
        - d. makes appropriate behavior responses to verbal messages
        - e. participates in discussion and identification of the difference between listening and hearing
    - 4. ***Speaking:** Organizes ideas and communicates orally*
        - a. participates in classroom discussions
        - b. organizes ideas and communicate specific questions to the instructor
        - c. verbally affirms understanding of a concept, procedure, or required skill
        - d. communicates with peers to ensure the smooth and safe operation of the laboratory
- B. ***Thinking Skills:** Thinks creatively, makes decisions, solves problems, visualizes, knows how to learn and reasons.*
    - 1. ***Creative Thinking:** Generates new ideas*
        - a. develops new ideas for approaching problem solving
        - b. participates in the "brain-storming" process
        - c. participates in group problem solving process
        - d. practices the team approach to problem solving
    - 2. ***Decision Making:** Specifies goals and constraints, generates alternatives, considers risks, and evaluates and chooses best alternative*
        - a. identifies personal goals
        - b. identifies actions required to accomplish personal goals
    - 3. ***Problem Solving:** Recognizes problems and devises and implements plan of action*
        - a. makes daily accommodations to stay on schedule
        - b. seeks additional instruction and clarification for assignment completion
        - c. balances social and academic life and responsibilities
        - d. accepts responsibility
    - 4. ***Seeing Things In the Mind's Eye:** Organizes, and processes symbols, pictures, graphs, objects, and other information*
        - a. interpret basic graphs and inspection reports; identifies inspection report symbols
        - b. interprets non-verbal communication in the classroom
    - 5. ***Knowing How to Learn:** Use efficient learning techniques to acquire and apply new knowledge and skills*
        - a. develops techniques for adapting learning style for differences in teaching style
        - b. utilizes techniques for creative thinking
        - c. develops strategies for effective problem solving approaches

6. ***Reasoning:*** *Discovers a rule or principle underlying the relationship between two or more objects and applies it when solving a problem*
    a. performs self-analysis of effective learning styles for specific situations
    b. selects appropriate communication from (oral vs. written) to effectively apply communication skills "on-the-job"
    c. communicates effectively within the workplace hierarchy

C. ***Personal Qualities:*** *Displays responsibility, self-esteem, sociability, self-management, and integrity and honesty.*

1. ***Responsibility:*** *Exerts a high level of effort and perseveres toward goal attainment*
    a. develops an understanding that in order to be successful you must be a "good" student
    b. develops an understanding that a "good" student is the one who is prompt to every class and has prepared for the day's work
    c. develops an understanding good students know what they are going to do in class and does not waste time
    d. develops a fine work ethic
2. ***Self-Esteem:*** *Believes in own self-worth and maintains a positive view of self*
    a. learns to take pride in his or her work through positive reinforcement
    b. sees himself or herself as an asset to the class through continued contributions to the group and a shared common goal
    c. understands that an individual with a positive attitude and the belief in their own abilities will systematically seek solutions and be a valuable employee
3. ***Sociability:*** *Demonstrates understanding, friendliness, adaptability, empathy, and politeness in group settings*
    a. assist classmates in improving technical skills
    b. assist students with special needs as a peer mentor
    c. discusses and demonstrates strategies for effective communication across cultures
4. ***Self-Management:*** *Assesses self accurately, sets personal goals, monitors progress, and exhibits self-control*
    a. assesses self/personal goals and monitors individual progress
    b. maintain a record of academic achievement (individual grade book)
    c. performs goal setting activities
5. ***Integrity/Honesty:*** *Chooses ethical courses of action*
    a. accepts the responsibility for own actions
    b. exhibit personal honesty at all times
    c. accept the challenge of doing your own work in the laboratory, during examinations, and on outside assignments
    d. understands the consequences of unethical behavior

APPENDIX A - INDUSTRY COMPETENCY PROFILES

The following pages contain the individual Competency Profiles for each of the companies surveyed by the MAST development center for the occupational specialty area of . These Competency Profiles/skill standards were used to develop the curriculum for the pilot program.

The participation of the companies as partners in the MAST effort is greatly appreciated. Each company has approved the use of its logo in MAST materials. None of the participating companies shall be held responsible or liable for any of the findings of the project.

SKILLS AND KNOWLEDGE

MORAINE VALLEY COMMUNITY COLLEGE
MAST PROGRAM REPRESENTATIVES

DR. RICHARD C. HINCKLEY
Dean of Instruction
Business/Industrial Technology

RICHARD A. KUKAC
Site Coordinator

Furnished By:

CONVEYORS PLUS, INC.

Herbert A. Zimmermann
President

Moraine Valley
Community College

TRAITS AND ATTITUDES

TOOLS AND EQUIPMENT

FUTURE TRENDS AND CONCERNS

COMPETENCY PROFILE
Mechanical Design Drafting Technician

Conducted By
M.A.S.T.
Machine Tool Advanced Skills
Technology Program
and
Consortium Partners
(V.199J40008)

Conveyors *Plus*, Inc.

COMPUTER-AIDED DRAFTING & DESIGN TECHNICIAN... **plan, layout and prepare engineering drawings, parts lists, diagrams, and related documents from layouts, sketches and notes using manual or computer-aided techniques following current industry and company standards.**

	Duties	Tasks												
A	**Apply Mathematical Concepts**	A-1 Perform Basic Arithmetic Operations	A-2 Compute Unit Conversions	A-3 Perform Basic Trigonometric Operations	A-4 Use Cartesian Coordinate System	A-5 Use Polar Coordinate System								
B	**Demonstrate Fundamental Drafting Skills**	B-1 Use Drawing Media and Related Drafting Materials	B-2 Use Measuring Scales	B-3 Identify Drafting Line Styles and Weights	B-4 Prepare Title Blocks and Other Drafting Formats	B-5 Create Technical Sketches								
C	**Plan and Organize Activities**	C-1 Determine Scope of Drafting Assignment	C-2 Select Appropriate Drafting Techniques for Drawings	C-3 Maintain Supporting Documents										
D	**Prepare Mechanical Production Drawings**	D-1 Understand and Apply Mechanical Drawing Methods	D-2 Create Detail Drawings	D-3 Create Assembly Drawings	D-4 Perform Technical Lettering	D-5 Create Bill of Material/ Parts List	D-6 Apply Dimensions and Notes	D-7 Perform Dimensional Limits and Tolerances	D-8 Apply Current Drafting Standards to Dawings	D-9 Perform Drawing Revisons	D-10 Use Commercial and Vendor Data			
E	**Assist Engineering Personnel**	E-1 Understand Basic Design Procedures	E-2 Utilize Fasteners for Mechanical Applications	E-3 Utilize Power Transmission Elements for Mechanical Applications	E-4 Utilize Bearings for Mechanical Applications	E-5 Understand Basic Manufacturing Methods	E-6 Utilize Brakes and Clutches for Mechanical Applications	E-7 Design Shafts for Use in Mechanical Applications						
F	**Use CAD System**	F-1 Start and Exit Software Program	F-2 Demonstrate Proper File Management Techniques	F-3 Use Directory Structure	F-4 Exit Drawing File	F-5 Utilize Drawing Set-Up Procedures	F-6 Use Geometric Objects	F-7 Use Text for Drawing Annotation	F-8 Control Object Properties	F-9 Use Viewing/ Display Commands	F-10 Use Standard Parts and/or Symbol Libraries	F-11 Understand Procedure to Print/Plot a Drawing	F-12 Use Standard Layering Techniques	F-13 Create Mechanical CAD Drawings
		F-14 Create 3D Mechanical Models	F-15 Utilize CAD Drawing Data	F-16 Use Drawing Feature Attributes	F-17 Obtain 3D Model Property Data	F-18 Use CAD Dimensioning Features	F-19 Use Third-Party Software for CAD Enhancement	F-20 Perform CAD Customization Procedures						

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Conveyors Plus, Inc.

December 27, 1995

Mr. Richard A. Kukac
Associate Dean
Moraine Valley community College
10900 South 88th Avenue
Palos Hills, IL 60465-0937

Dear Mr. Kukac

In response to your letter dated December 20, 1995.

Moraine Valley Community College shall have permission to include Conveyors Plus, Inc.'s name in and only in documentation being produced for the "Mechanical Design Drafting Technician" national standards and national program of curriculum.

Conveyors Plus, Inc. has in the past and will continue in the future to support the needs of quality education. Our participation in this program development has reinforced our commitment.

Any time should you need additional information please call me.

Sincerely
Conveyors Plus, Inc.

Herbert A. Zimmermann

Herbert A. Zimmermann
President

HAZ:bw

13301 Southwest Highway • Orland Park, Illinois 60462 • Tel (708) 361-1512 • Fax (708) 361-4372

SKILLS AND KNOWLEDGE

Communication Skills
Technical Reading/Writing Skills
Ability to Comprehend Written/Verbal Instructions
Leadership Skills
Organizational Skills
Knowledge of Company Policies/Procedures
Knowledge of Employee/Employer Responsibilities
Ability to Work as Part of a Team
Knowledge of Company Quality Assurance Activities
Knowledge of Safety Regulations/Responsibilities
Project/Task Management Skills
Logical/Systematic Problem Solving Skills
Computer Skills
Numerical/Mathematical Skills
Use Measurement Tools
Use Inspection Devices
Drafting Skills
Knowledge of Industrial Materials
Knowledge of Manufacturing Processes
Mechanical Aptitude

ITAWAMBA COMMUNITY COLLEGE MAST PROGRAM REPRESENTATIVES

Dr. Charles Chrestman
Dean/Director

Don Benjamin
Associate Dean/Site Administrator

Barry Emison
Site Coordinator

DELTA INTERNATIONAL REPRESENTATIVES

Ronald Boes
Manager - Product/Process Engineering

Bobby Donovan
Project Engineer

Jerry Ford
Product Designer

Dean Gann
CAD Technician

David Miller
Project Engineer

TRAITS AND ATTITUDES

Strong Work Ethic
Interpersonal Skills
Punctuality
Dependability
Honesty
Neatness
Safety Conscientious
Motivation
Responsible
Physical Ability
Professional
Trustworthy
Personal Ethics
Innovative

TOOLS AND EQUIPMENT

FUTURE TRENDS AND CONCERNS

Adaptive Controls
Composites
In-Process Gauging
Conversational Programming
Artificial Intelligence
Rapid Tool Changing
Expanded Communication with Shop Floor
Multi-Axis Equipment
Computer-Integrated Manufacturing

COMPETENCY PROFILE

CAD / CAM Technician

Prepared By
M.A.S.T.
Machine Tool Advanced Skills
Technology Program
and
Consortia Partners
(V.199J40008)

DELTA
A Pentair Company

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CAD/CAM TECHNICIAN .... use computer based systems to create part geometry, draft layouts, produce drawings, and write, edit, and download code to CNC machines

	Duties	← Tasks →												
A	Practice Safety	A-1 Follow safety manuals and all safety regulations/ requirements	A-2 Maintain safe equipment and machinery	A-3 Maintain a clean and safe work environment	A-4 Ensure safe operation of machines	A-5 Use safe machining practices	A-6 Use safe lifting practices	A-7 Use safe operating procedures for hand and machine tools	A-8 Consult and apply MSDS for hazards of various materials	A-9 Practice proper tag-out/ lock-out procedures				
B	Apply Mathematical Concepts	B-1 Perform basic arithmetic functions	B-2 Interconvert fractions/ decimals	B-3 Interconvert Metric/ English measurements	B-4 Perform basic algebraic operations	B-5 Perform basic trigonometric functions	B-6 Use basic geometric principles	B-7 Calculate and apply formulas	B-8 Use and apply basic concepts of physics	B-9 Use and apply cartesian coordinate system				
C	Demonstrate Quality Control and Management	C-1 Utilize appropriate inspection techniques	C-2 Perform appropriate use and calibration of inspection equipment	C-3 Know qualitative parameters of machinery and equipment	C-4 Know and use TQM techniques	C-5 Know and use SPC techniques and concepts	C-6 Know and use ISO 9000 concepts and procedures	C-7 Have working knowledge of coordinate measuring machine						
D	Demonstrate Knowledge of Manufacturing Materials	D-1 Identify materials with desired properties	D-2 Know machinability/ workability of various materials	D-3 Apply concepts of and calculate statics and stresses	D-4 Know stress relieving procedures	D-5 Demonstrate knowledge of heat treating procedures and properties	D-6 Determine, interpret, and evaluate availability of materials							
E	Demonstrate Knowledge of Manufacturing Processes	E-1 Know operation of vertical and horizontal mills and tooling	E-2 Know operation of engine and turret lathes and tooling	E-3 Know operation of drill presses and tooling	E-4 Know operation of surface and cylindrical grinders	E-5 Know operation of heat treating equipment/processes	E-6 Know operation of welding equipment	E-7 Know operation of wire EDM	E-8 Know operation of punch / brake presses and tooling	E-9 Know operation of plate shears	E-10 Know operation of jig-boring machines and tooling	E-11 Know operation of tool and cutter grinders	E-12 Know operation of band and radial arm saws	E-13 Know operation of laser machining systems
		E-14 Know proper flow of parts through shop	E-15 Have knowledge of CNC programming language	E-16 Calculate tonnages required for press operations	E-17 Calculate bend allowances / use yield tables for sheet metal operations	E-18 Apply conservation of material concepts	E-19 Calculate speeds and feeds based on materials and tooling	E-20 Utilize concepts and principles of fixturing	E-21 Utilize basic die theory	E-22 Estimate capacity of equipment or manpower	E-23 Establish standards and/ or rates			
F	Perform CNC Programming/ CAM Tasks	F-1 Prepare and plan for CNC machining operations	F-2 Select, use, and acquire tooling systems for CNC machines	F-3 Manually program CNC machines	F-4 Set and use tooling offsets at CNC machine	F-5 Use Computer-Aided-Manufacturing (CAM) system	F-6 Transfer files from CAM system to machine	F-7 Interconvert CAD and CAM files using DXF or IGES formats	F-8 Install and maintain file transfer systems	F-9 Configure CAM system parameters				
G	Perform Measurement/ Inspection	G-1 Know operation of O.D., I.D., and depth micrometers	G-2 Know operation of vernier, dial, & digital calipers	G-3 Read and use scale and tape measure	G-4 Know operation of dial-bore indicators	G-5 Know operation of dial indicators	G-6 Know operation of Rockwell hardness tester	G-7 Use digital read-out	G-8 Use finish/ profile gauges					
H	Demonstrate Communication Skills	H-1 Read, interpret, and apply memorandums, letters, and written instructions	H-2 Read, interpret, and apply technical reports, procedures and manuals	H-3 Communicate technical information verbally	H-4 Read, interpret, and apply graphs, charts, and other visual aids	H-5 Write technical reports, procedures, and guidelines								
I	Perform Drafting/CAD Tasks	I-1 Demonstrate traditional mechanical drafting skills	I-2 Use Computer-Aided Drafting (CAD) system	I-3 Create 3-D solid models	I-4 Use and apply GD&T methodology	I-5 Generate and/or apply industry or company standards	I-6 Interconvert CAD and DXF or IGES formats	I-7 Configure CAD system parameters						

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Duties		Tasks												
J	Use Computers	J-1 Use computer operating systems	J-2 Use file management systems	J-3 Perform backup on a personal computer	J-4 Use/Install software packages	J-5 Use computer network system	J-6 Use file transfer systems	J-7 Understand and apply computer terminology	J-8 Have working knowledge of hardware components					
K	Participate in Product Design Activities	K-1 Design parts for manufacturability	K-2 Design parts for functionality	K-3 Design parts for marketability	K-4 Plan and design for "mating of parts"	K-5 Be cost conscious with design of parts	K-6 Incorporate safety into product design	K-7 Determine, interpret, and evaluate customer specifications	K-8 Design, document, and validate testing methods	K-9 Coordinate production of prototype				
L	Interpret/Use Blueprints and Related Documents	L-1 Interpret, review, and apply blueprint notes, dimensions, and tolerances	L-2 Interpret and understand basic layout/ types of drawings	L-3 Understand and analyze bill of materials	L-4 Ascertain job requirements from drawings	L-5 Interpret and apply geometric dimensioning and tolerancing	L-6 Interpret and apply electrical schematic diagrams	L-7 Interpret and apply hydraulic or pneumatic diagrams	L-8 Interpret and apply plant layout drawings					
M	Manage Projects/Tasks	M-1 Compile and collate information	M-2 Conduct multiple project management	M-3 Set and maintain timelines	M-4 Prioritize tasks/duties/ projects	M-5 Preplan project activities	M-6 Demonstrate time/resource management	M-7 Perform research	M-8 Comprehend entire scope of project	M-9 Assess and evaluate / revise or modify project layout				

SKILLS AND KNOWLEDGE

MORAINE VALLEY COMMUNITY COLLEGE
MAST PROGRAM REPRESENTATIVES

DR. RICHARD C. HINCKLEY
Dean of Instruction
Business/Industrial Technology

RICHARD A. KUKAC
Site Coordinator

Furnished By:

ELECTRO-MOTIVE DIVISION
GENERAL MOTORS CORP.

William T. Ostrowski
Senior Designer

Moraine Valley
Community College

TRAITS AND ATTITUDES

TOOLS AND EQUIPMENT

FUTURE TRENDS AND CONCERNS

COMPETENCY PROFILE

Mechanical Design Drafting Technician

Conducted By
M.A.S.T.
Machine Tool Advanced Skills
Technology Program
and
Consortia Partners
(V.199J40008)

EMD GM

ELECTRO-MOTIVE
General Motors Corporation

MECHANICAL DESIGN DRAFTING TECHNICIAN... plan, layout and prepare engineering drawings, parts lists, diagrams, and related documents from layouts, sketches and notes using manual or computer-aided techniques following current industry and company standards.

	Duties	← **Tasks** →												
A.	**Apply Mathematical Concepts**	A-1 Perform Basic Arithmetic Operations	A-2 Compute Unit Conversions	A-3 Perform Basic Trigonometric Operations	A-4 Use Cartesian Coordinate System	A-5 Use Polar Coordinate System								
B.	**Demonstrate Fundamental Drafting Skills**	B-1 Use Drawing Media and Related Drafting Materials	B-2 Use Measuring Scales	B-3 Identify Drafting Line Styles and Weights	B-4 Prepare Title Blocks and Other Drafting Formats	B-5 Create Technical Sketches								
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ELECTRO-MOTIVE

Electro-Motive Division General Motors Corporation, La Grange, Illinois 60525 (708) 387-6000

January 10, 1996

Mr. Richard A. Kukac
Moraine Valley Community College
10900 South 88th Avenue
Palos Hills, IL 60465-0937

Dear Mr. Kukac:

This is in response to your letter dated December 20, 1995 asking for permission to include Electro-Motive's name in the curriculum documentation being produced for "Mechanical Design Drafting Technician".

I spoke with one of our corporate lawyers and he said their would be no problem with using our name.

If you need to get in touch with me I can be reached at (708) 387-5974.

Sincerely,

William T. Ostrowski

William T. Ostrowski
Senior Designer
Electro-Motive Division
Department 812A
Fax: 708-387-6137

WTO/ds

SKILLS AND KNOWLEDGE

Communication Skills
Technical Reading/Writing Skills
Ability to Comprehend Written/Verbal Instructions
Leadership Skills
Organizational Skills
Knowledge of Company Policies/Procedures
Knowledge of Employee/Employer Responsibilities
Ability to Work as Part of a Team
Knowledge of Company Quality Assurance Activities
Knowledge of Safety Regulations/Responsibilities
Project/Task Management Skills
Logical/Systematic Problem Solving Skills
Computer Skills
Numerical/Mathematical Skills
Use Measurement Tools
Use Inspection Devices
Drafting Skills
Knowledge of Industrial Materials
Knowledge of Manufacturing Processes
Mechanical Aptitude

ITAWAMBA COMMUNITY COLLEGE MAST PROGRAM REPRESENTATIVES

Dr. Charles Chrestman
Dean/Director

Don Benjamin
Associate Dean/Site Administrator

Barry Emison
Site Coordinator

FMC CORPORATION REPRESENTATIVES

Kevin Andrews
Machine Designer

Lynwood Hamilton Jr.
Manufacturing Engineering Manager

Scott Lawrence
Lead Engineer

Michael Mihelic
N.C. Programmer

Ronald Murphy
Metal Layout

Robin Thornton
Machine Designer

TRAITS AND ATTITUDES

Strong Work Ethic
Interpersonal Skills
Punctuality
Dependability
Honesty
Neatness
Safety Conscientious
Motivation
Responsible
Physical Ability
Professional
Trustworthy
Personal Ethics
Innovative

TOOLS AND EQUIPMENT

FUTURE TRENDS AND CONCERNS

Expanded Communication with Shop Floor
Multi-Axis Equipment
Computer-Integrated Manufacturing

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COMPETENCY PROFILE

CAD / CAM Technician

Prepared By
M.A.S.T.
Machine Tool Advanced Skills
Technology Program
and
Consortia Partners
(V.199J40008)

FMC

CAD/CAM TECHNICIAN .... use computer based systems to create part geometry, draft layouts, produce drawings, and write, edit, and download code to CNC machines

	Duties	← Tasks →												
A	Practice Safety	A-1 Follow safety manuals and all safety regulations/ requirements	A-2 Maintain safe equipment and machinery	A-3 Maintain a clean and safe work environment	A-4 Ensure safe operation of machines	A-5 Use safe machining practices	A-6 Use safe lifting practices	A-7 Use safe operating procedures for hand and machine tools	A-8 Consult and apply MSDS for hazards of various materials	A-9 Practice proper tag-out/ lock-out procedures	A-10 Practice electrical safety procedures			
B	Apply Mathematical Concepts	B-1 Perform basic arithmetic functions	B-2 Interconvert fractions/ decimals	B-3 Interconvert Metric/ English measurements	B-4 Perform basic algebraic operations	B-5 Perform basic trigonometric functions	B-6 Use basic geometric principles	B-7 Calculate and apply formulas	B-8 Use and apply basic concepts of technical physics	B-9 Use and apply cartesian coordinate system				
C	Demonstrate Quality Control and Management	C-1 Utilize appropriate inspection techniques	C-2 Perform appropriate use and calibration of inspection equipment	C-3 Know qualitative parameters of machinery and equipment	C-4 Know and use TQM techniques	C-5 Maintain equipment to produce quality parts	C-6 Know and use SPC techniques and concepts	C-7 Know and use ISO 9000 concepts and procedures	C-8 Know operation of coordinate measuring machine					
D	Demonstrate Knowledge of Manufacturing Materials	D-1 Identify materials with desired properties	D-2 Know machinability/ workability of various materials	D-3 Apply concepts of and calculate statics and stresses	D-4 Know/Find hardness characteristics/ chemistry of various material	D-5 Demonstrate knowledge of heat treating procedures and properties	D-6 Demonstrate knowledge of carbon index	D-7 Know stress relieving procedures	D-8 Determine, interpret, and evaluate availability of materials					
E	Demonstrate Knowledge of Manufacturing Processes	E-1 Know operation of vertical and horizontal mills and tooling	E-2 Know operation of engine and turret lathes and tooling	E-3 Know operation of drill presses and tooling	E-4 Know operation of surface and cylindrical grinders	E-5 Know operation of heat treating equipment	E-6 Know operation of welding equipment	E-7 Know operation of gas cutting equipment	E-8 Know operation of punch / brake presses and tooling	E-9 Know operation of plate shears	E-10 Know operation of jig-boring machines and tooling	E-11 Know operation of tool and cutter grinders	E-12 Know operation of band and radial arm saws	E-13 Estimate time required/ cost to produce a part
		E-14 Know proper flow of parts through shop	E-15 Have knowledge of CNC programming language	E-16 Calculate tonnages required for press operations	E-17 Calculate bend allowances / use yield tables for sheet metal operations	E-18 Apply conservation of material concepts	E-19 Calculate speeds and feeds based on materials and tooling	E-20 Utilize concepts and principles of fixturing	E-21 Utilize basic die theory	E-22 Estimate capacity of equipment or manpower	E-23 Establish standards and/ or rates	E-24 Know operation of wire EDM	E-25 Know basic concepts of industrial painting/ plating	
F	Perform CNC Programming/ CAM Tasks	F-1 Prepare and plan for CNC machining operations	F-2 Select, use, and acquire tooling systems for CNC machines	F-3 Manually program CNC machines	F-4 Set and use tooling offsets at CNC machine	F-5 Use Computer-Aided Manufacturing (CAM) system	F-6 Transfer files from CAM system to machine	F-7 Interconvert CAD and CAM files using DXF or IGES formats	F-8 Install and maintain file transfer systems	F-9 Configure CAM system parameters				
G	Perform Measurement/ Inspection	G-1 Know operation of O.D., I.D., and depth micrometers	G-2 Know operation of vernier, dial, & digital calipers	G-3 Read and use scale and tape measure	G-4 Know operation of dial-bore indicators	G-5 Know operation of dial indicators	G-6 Use precision square, center head, and protractor	G-7 Use digital read-out	G-8 Use finish/ profile gauges	G-9 Know operation of Rockwell hardness tester				
H	Demonstrate Communication Skills	H-1 Read, interpret, and apply memorandums, letters, and written instructions	H-2 Read, interpret, and apply technical reports, procedures and manuals	H-3 Communicate technical information verbally	H-4 Read, interpret, and apply graphs, charts, and other visual aids	H-5 Write technical reports, procedures, and guidelines								
I	Perform Drafting/CAD Tasks	I-1 Demonstrate traditional mechanical drafting skills	I-2 Use Computer-Aided Drafting (CAD) system	I-3 Create 3-D solid models	I-4 Use and apply GD&T methodology	I-5 Generate and/or apply industry or company standards	I-6 Interconvert CAD and DXF or IGES formats	I-7 Configure CAD system parameters						

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Duties		Tasks												
J	Use Computers	J-1 Use computer operating systems	J-2 Use file management systems	J-3 Perform backup on a personal computer	J-4 Use software packages	J-5 Use computer network system	J-6 Use file transfer systems	J-7 Understand and apply computer terminology	J-8 Have working knowledge of hardware components	J-9 Understand RS-232 protocol				
K	Participate in Product Design Activities	K-1 Design parts for manufacturability	K-2 Design parts for functionality	K-3 Design parts for marketability	K-4 Plan and design for "mating of parts"	K-5 Be cost conscious with design of parts	K-6 Incorporate safety into product design	K-7 Determine, interpret, and evaluate customer specifications	K-8 Design, document, and validate testing methods					
L	Interpret/Use Blueprints and Related Documents	L-1 Interpret, review, and apply blueprint notes, dimensions, and tolerances	L-2 Interpret and understand basic layout/ types of drawings	L-3 Understand and analyze bill of materials	L-4 Ascertain job requirements from drawings	L-5 Interpret and apply geometric dimensioning and tolerancing	L-6 Interpret and apply electrical schematic diagrams	L-7 Interpret and apply hydraulic or pneumatic diagrams	L-8 Interpret and apply plant layout drawings					
M	Manage Projects/Tasks	M-1 Compile and collate information	M-2 Conduct multiple project management	M-3 Set and maintain timelines	M-4 Prioritize tasks/duties/ projects	M-5 Preplan project activities	M-6 Demonstrate time/resource management	M-7 Perform research	M-8 Comprehend entire scope of project	M-9 Assess and evaluate / Revise or modify project layout				

SKILLS AND KNOWLEDGE
Communication Skills
Technical Reading/Writing Skills
Ability to Comprehend Written/Verbal Instructions
Leadership Skills
Organizational Skills
Knowledge of Company Policies/Procedures
Knowledge of Employee/Employer Responsibilities
Ability to Work as Part of a Team
Knowledge of Company Quality Assurance Activities
Knowledge of Safety Regulations/Responsibilities
Project/Task Management Skills
Logical/Systematic Problem Solving Skills
Computer Skills
Numerical/Mathematical Skills
Use Measurement Tools
Use Inspection Devices
Drafting Skills
Knowledge of Industrial Materials
Knowledge of Manufacturing Processes
Mechanical Aptitude

ITAWAMBA COMMUNITY COLLEGE MAST PROGRAM REPRESENTATIVES

Dr. Charles Chrestman
Dean/Director

Don Benjamin
Associate Dean/Site Administrator

Barry Emison
Site Coordinator

ITT ENGINEERED VALVES REPRESENTATIVES

Randy Bates
Designer

Timothy Sumrall
Designer

Jimmy Wiygul
CNC Machinist

Dewayne Welch
CNC Operator

Harris Clay Simmons
CNC Machinist

TRAITS AND ATTITUDES
Strong Work Ethic
Interpersonal Skills
Punctuality
Dependability
Honesty
Neatness
Safety Conscientious
Motivation
Responsible
Physical Ability
Professional
Trustworthy
Personal Ethics
Innovative

TOOLS AND EQUIPMENT

FUTURE TRENDS AND CONCERNS
Adaptive Controls
Composites
In-Process Gauging
Conversational Programming
Artificial Intelligence
Rapid Tool Changing
Expended Communication with Shop Floor
Multi-Axis Equipment
Computer-Integrated Manufacturing

COMPETENCY PROFILE

CAD / CAM
Technician

Prepared By
M.A.S.T.
Machine Tool Advanced Skills
Technology Program
and
Consortia Partners
(V.199J40008)

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CAD/CAM TECHNICIAN .... use computer based systems to create part geometry, draft layouts, produce drawings, and write, edit, and download code to CNC machines

Duties		Tasks												
A	Practice Safety	A-1 Follow safety manuals and all safety regulations/ requirements	A-2 Maintain safe equipment and machinery	A-3 Maintain a clean and safe work environment	A-4 Ensure safe operation of machines	A-5 Use safe machining practices	A-6 Use safe lifting practices	A-7 Use safe operating procedures for hand and machine tools	A-8 Consult and apply MSDS for hazards of various materials	A-9 Practice electrical safety procedures				
B	Apply Mathematical Concepts	B-1 Perform basic arithmetic functions	B-2 Interconvert fractions/ decimals	B-3 Interconvert Metric/ English measurements	B-4 Perform basic algebraic operations	B-5 Perform basic trigonometric functions	B-6 Use basic geometric principles	B-7 Calculate and apply formulas	B-8 Use and apply basic concepts of technical physics					
C	Demonstrate Quality Control and Management	C-1 Utilize appropriate inspection techniques	C-2 Perform appropriate use and calibration of inspection equipment	C-3 Know qualitative parameters of machinery and equipment	C-4 Know and use SPC techniques and concepts	C-5 Know and use ISO 9000 concepts and procedures	C-6 Know and use TQM techniques	C-7 Use coordinate measuring machine	C-8 Document inspection results					
D	Demonstrate Knowledge of Manufacturing Materials	D-1 Identify materials with desired properties	D-2 Know machinability/ workability of various materials	D-3 Apply concepts of and calculate statics and stresses	D-4 Know/Find hardness characteristics/ chemistry of various material	D-5 Demonstrate knowledge of heat treating procedures and properties	D-6 Demonstrate knowledge of carbon index	D-7 Know stress relieving procedures	D-8 Determine, interpret, and evaluate availability of materials					
E	Demonstrate Knowledge of Manufacturing Processes	E-1 Know operation of vertical and horizontal mills and tooling	E-2 Know operation of engine and turret lathes and tooling	E-3 Know operation of drill presses and tooling	E-4 Know operation of surface and cylindrical grinders	E-5 Know operation of heat treating equipment	E-6 Know operation of welding equipment	E-7 Know operation of ga cutting equipment	E-8 Know operation of punch / brake presses and tooling	E-9 Know operation of plate shears	E-10 Know operation of jig-boring machines and tooling	E-11 Know operation of tool and cutter grinders	E-12 Know operation of band and radial arm saws	E-13 Utilize basic concept of fixturing
		E-14 Know proper flow of parts through shop	E-15 Have knowledge of CNC programming language	E-16 Calculate tonnages required for press operations	E-17 Calculate bend allowances / use yield tables for sheet metal operations	E-18 Apply conservation of material concepts	E-19 Make calculations for sine bar and sine plate	E-20 Make calculations for rotary table and dividing head	E-21 Estimate time required/ cost to produce a part	E-22 Know operation of wire EDM	E-24 Utilize basic die theory			
F	Perform CNC Programming/ CAM Tasks	F-1 Prepare and plan for CNC machining operations	F-2 Select, use, and acquire tooling systems for CNC machines	F-3 Manually program CNC machines	F-4 Set and use tooling offsets at CNC machine	F-5 Use Computer-Aided-Manufacturing (CAM) system	F-6 Transfer files from CAM system to machine	F-7 Interconvert CAD and CAM files using DXF or IGES formats						
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ITTCCT PM3
MAFTN U111191

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Duties		Tasks													
J	Use Computers	J-1 Use computer operating systems	J-2 Use file management systems	J-3 Perform backup on a personal computer	J-4 Use/install software packages	J-5 Use computer network system	J-6 Use file transfer systems	J-7 Understand and apply computer terminology							
K	Participate in Product Design Activities	K-1 Design parts for manufacturability	K-2 Design parts for functionality	K-3 Design parts for marketability	K-4 Plan and design for "mating of parts"	K-5 Be cost conscious with design of parts	K-6 Incorporate safety into product design								
L	Interpret/Use Blueprints and Related Documents	L-1 Interpret, review, and apply blueprint notes, dimensions, and tolerances	L-2 Interpret and understand basic layout/ types of drawings	L-3 Understand and analyze bill of materials	L-4 Ascertain job requirements from drawings	L-5 Interpret and apply geometric dimensioning and tolerancing	L-6 Interpret and apply hydraulic and pneumatic diagrams								
M	Manage Projects/Tasks	M-1 Compile and collate information	M-2 Comprehend entire scope of project	M-3 Set and maintain timelines	M-4 Prioritize tasks/duties/ projects	M-5 Preplan project activities	M-6 Demonstrate time/resource management	M-7 Perform research							

SKILLS AND KNOWLEDGE

Communication Skills
Technical Reading/Writing Skills
Ability to Comprehend Written/Verbal Instructions
Leadership Skills
Organizational Skills
Knowledge of Company Policies/Procedures
Knowledge of Employee/Employer Responsibilities
Ability to Work as Part of a Team
Knowledge of Company Quality Assurance Activities
Knowledge of Safety Regulations/Responsibilities
Project/Task Management Skills
Logical/Systematic Problem Solving Skills
Computer Skills
Numerical/Mathematical Skills
Use Measurement Tools
Use Inspection Devices
Drafting Skills
Knowledge of Industrial Materials
Knowledge of Manufacturing Processes
Mechanical Aptitude

ITAWAMBA COMMUNITY COLLEGE MAST PROGRAM REPRESENTATIVES

Dr. Charles Chrestman
Dean/Director

Don Benjamin
Associate Dean/Site Administrator

Barry Emison
Site Coordinator

KRUEGER INTERNATIONAL REPRESENTATIVES

Jeffrey Roberts
CAD/CAM Operator

John Webb
TQM Coordinator

TRAITS AND ATTITUDES

Strong Work Ethic
Interpersonal Skills
Punctuality
Dependability
Honesty
Neatness
Safety Conscientious
Motivation
Responsible
Physical Ability
Professional
Trustworthy
Personal Ethics
Innovative

TOOLS AND EQUIPMENT

FUTURE TRENDS AND CONCERNS

COMPETENCY PROFILE

CAD / CAM Technician

Prepared By
M.A.S.T.
Machine Tool Advanced Skills
Technology Program
and
Consortia Partners
(V.199J40008)

KI

CAD/CAM TECHNICIAN .... use computer based systems to create part geometry, draft layouts, produce drawings, and write, edit, and download code to CNC machines

	Duties	← Tasks →												
A	Practice Safety	A-1 Follow safety manuals and all safety regulations/ requirements	A-2 Maintain safe equipment and machinery	A-3 Maintain a clean and safe work environment	A-4 Ensure safe operation of machines	A-5 Use safe machining practices	A-6 Use safe lifting practices	A-7 Use safe operating procedures for hand and machine tools	A-8 Practice electrical safety procedures	A-9 Practice proper tag-out/ lock-out procedures				
B	Apply Mathematical Concepts	B-1 Perform basic arithmetic functions	B-2 Interconvert fractions/ decimals	B-3 Interconvert Metric/ English measurements	B-4 Perform basic algebraic operations	B-5 Perform basic trigonometric functions	B-6 Use basic geometric principles	B-7 Calculate and apply formulas						
C	Demonstrate Quality Control and Management	C-1 Utilize appropriate inspection techniques	C-2 Know and use ISO 9000 concepts and procedures	C-3 Know qualitative parameters of equipment	C-4 Know and use TQM techniques	C-5 Maintain equipment to produce quality parts								
D	Interpret/Use Blueprints and Related Documents	D-1 Interpret, review, and apply blueprint notes, dimensions, and tolerances	D-2 Interpret and understand basic layout/ types of drawings	D-3 Understand and analyze bill of materials	D-4 Interpret and apply plant layout drawings									
E	Use Computers	E-1 Use computer operating systems	E-2 Use file management systems	E-3 Perform backup on a personal computer	E-4 Install/use software packages	E-5 Have working knowledge of hardware components	E-6 Use file transfer systems	E-7 Understand and apply computer terminology						
F	Manage Projects/Tasks	F-1 Demonstrate time/resource management	F-2 Comprehend entire scope of project	F-3 Set and maintain timelines	F-4 Assess and evaluate / Revise or modify project layout	F-5 Preplan project activities								
G	Perform CNC Programming/ CAM Tasks	G-1 Prepare and plan for CNC machining operations	G-2 Select, use, and acquire tooling systems for CNC machines	G-3 Manually program CNC machines	G-4 Set and use tooling offsets at CNC machine	G-5 Use Computer-Aided-Manufacturing (CAM) system	G-6 Install and maintain file transfer systems	G-7 Interconvert CAD and CAM files using DXF or IGES formats						
H	Perform Measurement/ Inspection	H-1 Know operation of O.D., I.D., and depth micrometers	H-2 Know operation of vernier, dial, & digital calipers	H-3 Read and use scale and tape measure	H-4 Use precision square, center head, and protractor	H-5 Know operation of dial indicators								
I	Demonstrate Communication Skills	I-1 Read, interpret, and apply memorandums, letters, and written instructions	I-2 Read, interpret, and apply technical reports, procedures and manuals	I-3 Communicate technical information verbally	I-4 Read, interpret, and apply graphs, charts, and other visual aids	I-5 Write memorandums, letters, and written instructions								
J	Perform Drafting/CAD Tasks	J1 Interconvert CAD and DXF or IGES formats	J-2 Use Computer-Aided Drafting (CAD) system	J-3 Configure CAD system parameters	J-4 Use and apply GD&T methodology	J-5 Generate and/or apply industry or company standards								

[illegible]
[illegible]

SKILLS AND KNOWLEDGE

MORAINE VALLEY COMMUNITY COLLEGE
MAST PROGRAM REPRESENTATIVES

DR. RICHARD C. HINCKLEY
Dean of Instruction
Business/Industrial Technology

RICHARD A. KUKAC
Site Coordinator

Furnished By:

RAPISTAN DEMAG CORP

W. D. Korngiebel
Systems Group Manager

Moraine Valley
Community College

TRAITS AND ATTITUDES

TOOLS AND EQUIPMENT

FUTURE TRENDS AND CONCERNS

COMPETENCY PROFILE
Mechanical Design Drafting Technician

Conducted By
M.A.S.T.
Machine Tool Advanced Skills
Technology Program
and
Consortia Partners
(V.199J40008)

Rapistan DEMAG

MECHANICAL DESIGN DRAFTING TECHNICIAN... **plan, layout and prepare engineering drawings, parts lists, diagrams, and related documents from layouts, sketches and notes using manual or computer-aided techniques following current industry and company standards.**

	Duties	Tasks												
A	Apply Mathematical Concepts	A-1 Perform Basic Arithmetic Operations	A-2 Compute Unit Conversions	A-3 Perform Basic Trigonometric Operations	A-4 Use Cartesian Coordinate System	A-5 Use Polar Coordinate System								
B	Demonstrate Fundamental Drafting Skills	B-1 Use Drawing Media and Related Drafting Materials	B-2 Use Measuring Scales	B-3 Identify Drafting Line Styles and Weights	B-4 Prepare Title Blocks and Other Drafting Formats	B-5 Create Technical Sketches								
C	Plan and Organize Activities	C-1 Determine Scope of Drafting Assignment	C-2 Select Appropriate Drafting Techniques for Drawings	C-3 Maintain Supporting Documents										
D	Prepare Mechanical Production Drawings	D-1 Understand and Apply Mechanical Drawing Methods	D-2 Create Detail Drawings	D-3 Create Assembly Drawings	D-4 Perform Technical Lettering	D-5 Create Bill of Material/ Parts List	D-6 Apply Dimensions and Notes	D-7 Perform Dimensional Limits and Tolerances	D-8 Apply Current Drafting Standards to Dawings	D-9 Perform Drawing Revisons	D-10 Use Commercial and Vendor Data			
E	Assist Engineering Personnel	E-1 Understand Basic Design Procedures	E-2 Utilize Fasteners for Mechanical Applications	E-3 Utilize Power Transmission Elements for Mechanical Applications	E-4 Utilize Bearings for Mechanical Applications	E-5 Understand Basic Manufacturing Methods	E-6 Utilize Brakes and Clutches for Mechanical Applications	E-7 Design Shafts for Use in Mechanical Applications						
F	Use CAD System	F-1 Start and Exit Software Program	F-2 Demonstrate Proper File Management Techniques	F-3 Use Directory Structure	F-4 Exit Drawing File	F-5 Utilize Drawing Set-Up Procedures	F-6 Use Geometric Objects	F-7 Use Text for Drawing Annotation	F-8 Control Object Properties	F-9 Use Viewing/ Display Commands	F-10 Use Standard Parts and/or Symbol Libraries	F-11 Understand Procedure to Print/Plot a Drawing	F-12 Use Standard Layering Techniques	F-13 Create Mechanical CAD Drawings
		F-14 Create 3D Mechanical Models	F-15 Utilize CAD Drawing Data	F-16 Use Drawing Feature Attributes	F-17 Obtain 3D Model Property Data	F-18 Use CAD Dimensioning Features	F-19 Use Third-Party Software for CAD Enhancement	F-20 Perform CAD Customization Procedures						

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Midwest Regional Office

Rapistan Demag Corp.
1020 31st Street
Suite 325
Downers Grove, IL 60515-5505

Phone: (708) 852-9200
Fax: (708) 852-9351

February 22, 1996

Mr. Richard A. Kukac
Moraine Valley Community College
10900 South 88th Ave.
Palos Hills, IL 60465-0937

Dear Mr. Kukac:

This letter is your authorization to include Rapistan Demag Corporation's name in the curriculum documentation for the "Mechanical Design Drafting Technician". This document will be used exclusively to provide information to high school and college students about the career opportunities and educational requirements for this specific occupation.

Mr. Greg Manka is also obtaining a camera ready company logo for this curriculum documentation. Thank you for your assistance. If there is anything else I can do, please let me know.

Sincerely,

W. D. Korngiebel

W. D. Korngiebel
Systems Group Manager

sd

wdk96033

SKILLS AND KNOWLEDGE

Communication Skills
Use Measurement Tools
Use Inspection Devices
Mathematical Skills
Reading/Writing Skills
Knowledge of Safety Regulations
Practice Safety in the Workplace
Organizational Skills
Knowledge of Company Policies/Procedures
Mechanical Aptitude
Ability to Comprehend Written/Verbal Instructions
Knowledge of Cutting Fluids/Lubricants
Basic Knowledge of Fasteners
Ability to Work as Part of a Team
Converse in the Technical Language of the Trade
Knowledge of Occupational Opportunities
Knowledge of Employee/Employer Responsibilities
Knowledge of Company Quality Assurance Activities
Practice Quality-Consciousness in Performance of the Job

TEXAS STATE TECHNICAL COLLEGE WACO MAST PROGRAM REPRESENTATIVES

DR. HUGH ROGERS
Director

DR. JON BOTSFORD
Assistant Director

TERRY SAWMA
Research Coordinator

WALLACE PELTON
Site Coordinator

ROSE MARY TIMMONS
Senior Secretary/Statistician

REED TOOL COMPANY REPRESENTATIVE

GARY FRIETAG
CAD/CAM Technician

TODD KRAMER
CAD/CAM Technician

Texas State Technical College Waco

TRAITS AND ATTITUDES

Strong Work Ethic
Interpersonal Skills
Punctuality
Dependability
Honesty
Neatness
Safety Conscientious
Motivation
Responsible
Physical Ability
Professional
Trustworthy
Customer Relations
Personal Ethics

TOOLS AND EQUIPMENT

FUTURE TRENDS AND CONCERNS

COMPETENCY PROFILE
Computer-Aided Drafting Technician

Conducted By
M.A.S.T.
Machine Tool Advanced Skills Technology Program
and
Consortia Partners
(V.199J40008)

Texas State Technical College Waco

REED
TOOL COMPANY
A SUBSIDIARY OF CAMCO

COMPUTER-AIDED DRAFTING TECHNICIAN .... **use computer based drafting systems to produce drawings for electrical, architectural and manufacturing applications.**

	Duties	← Tasks →												
A	**Practice Safety**	A-1 Follow safety manuals and all safety regulations/ requirements	A-2 Use protective equipment	A-3 Maintain a clean and safe work environment										
B	**Apply Mathematical Concepts**	B-1 Perform basic arithmetic functions	B-2 Interconvert fractions/ decimals	B-3 Interconvert Metric/ English measurements	B-4 Perform basic trigonometric functions	B-5 Calculate draft angle dimensions	B-6 Apply "shrink rate" formulas							
C	**Perform Drafting Tasks**	C-1 Demonstrate traditional mechanical drafting skills	C-2 Use Computer-Aided Drafting (CAD) system	C-3 Use standards for drawings	C-4 Interpret and apply GD&T methodology									
D	**Use Computers**	D-1 Use computer operating systems	D-2 Use computer inquiry systems	D-3 Use various computer applications										
E	**Understand Manufacturing Materials and Processes**	E-1 Select materials with desired properties	E-2 Identify materials and processes to produce a product	E-3 Identify heat treating processes	E-4 Understand casting processes	E-5 Understand hot working processes	E-6 Understand cold working processes	E-7 Evaluate alternative manufacturing processes						
F	**Demonstrate Measurement/ Inspection Techniques**	F-1 Identify types of measurement used in manufacturing	F-2 Practice proper measuring skills	F-3 Use Metric and English standards of measurement	F-4 Perform measurements with hand held instruments									
G	**Participate in Total Quality and SPC Activities**	G-1 Define quality in manufacturing and explain importance	G-2 Implement concepts of quality in the workplace	G-3 Apply principles and tools of continuous quality improvement	G-4 Understand and apply SPC	G-5 Participate in the ISO 9001 Quality Program								

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SKILLS AND KNOWLEDGE

Communication Skills
Technical Reading/Writing Skills
Ability to Comprehend Written/Verbal Instructions
Leadership Skills
Organizational Skills
Knowledge of Company Policies/Procedures
Knowledge of Employee/Employer Responsibilities
Ability to Work as Part of a Team
Knowledge of Company Quality Assurance Activities
Knowledge of Safety Regulations/Responsibilities
Project/Task Management Skills
Logical/Systematic Problem Solving Skills
Computer Skills
Numerical/Mathematical Skills
Use Measurement Tools
Use Inspection Devices
Drafting Skills
Knowledge of Industrial Materials
Knowledge of Manufacturing Processes
Mechanical Aptitude

ITAWAMBA COMMUNITY COLLEGE MAST PROGRAM REPRESENTATIVES

Dr. Charles Chrestman
Dean/Director

Don Benjamin
Associate Dean/Site Administrator

Barry Emison
Site Coordinator

SUPER SAGLESS CORP. REPRESENTATIVE

Mark Hodges
Chief Engineer - Tool Design

TRAITS AND ATTITUDES

Strong Work Ethic
Interpersonal Skills
Punctuality
Dependability
Honesty
Neatness
Safety Conscientious
Motivation
Responsible
Physical Ability
Professional
Trustworthy
Personal Ethics
Innovative

TOOLS AND EQUIPMENT

FUTURE TRENDS AND CONCERNS

Composites
In-Process Gauging
Rapid Tool Changing
Expended Communication with Shop Floor
Multi-Axis Equipment
Computer-Integrated Manufacturing

COMPETENCY PROFILE

CAD / CAM
Technician

Prepared By
M.A.S.T.
Machine Tool Advanced Skills
Technology Program
and
Consortia Partners
(V.199J40008)

CAD/CAM TECHNICIAN .... use computer based systems to create part geometry, draft layouts, produce drawings, and write, edit, and download code to CNC machines

	Duties	Tasks												
A	Practice Safety	A-1 Follow safety manuals and all safety regulations/ requirements	A-2 Maintain safe equipment and machinery	A-3 Maintain a clean and safe work environment	A-4 Ensure safe operation of machines	A-5 Use safe machining practices	A-6 Use safe lifting practices	A-7 Use safe operating procedures for hand and machine tools	A-8 Consult and apply MSDS for hazards of various materials	A-9 Practice proper tag-out/ lock-out procedures	A-10 Practice electrical safety procedures			
B	Apply Mathematical Concepts	B-1 Perform basic arithmetic functions	B-2 Perform basic algebraic operations	B-3 Perform basic trigonometric functions	B-4 Use basic geometric principles	B-5 Calculate and apply formulas	B-6 Use and apply basic concepts of technical physics							
C	Demonstrate Quality Control and Management	C-1 Utilize appropriate inspection techniques	C-2 Perform appropriate use and calibration of inspection equipment	C-3 Know qualitative parameters of machinery and equipment	C-4 Maintain equipment to produce quality parts	C-5 Know operation of coordinate measuring machine								
D	Demonstrate Knowledge of Manufacturing Materials	D-1 Identify materials with desired properties	D-2 Know machinability/ workability of various materials	D-3 Determine, interpret, and evaluate availability of materials	D-4 Know/Find hardness characteristics/ chemistry of various material	D-5 Know stress relieving procedures	D-6 Demonstrate knowledge of carbon index							
E	Demonstrate Knowledge of Manufacturing Processes	E-1 Know operation of vertical and horizontal mills and tooling	E-2 Know operation of engine and turret lathes and tooling	E-3 Know operation of drill presses and tooling	E-4 Know operation of surface and cylindrical grinders	E-5 Know operation of heat treating equipment	E-6 Know operation of wire EDM	E-7 Know operation of laser machining	E-8 Utilize basic die theory	E-9 Know operation of plate shears	E-10 Know operation of jig-boring machines and tooling	E-11 Schedule preventative maintenance for tooling and/or machines	E-12 Utilize concepts and principles of fixturing	E-13 Calculate speeds and feeds based on materials and tooling
		E-14 Know proper flow of parts through shop	E-15 Have knowledge of CNC programming language	E-16 Make calculations for sine bar/plate	E-17 Calculate bend allowances / use yield tables for sheet metal operations	E-18 Apply conservation of material concepts								
F	Perform CNC Programming/ CAM Tasks	F-1 Prepare and plan for CNC machining operations	F-2 Select, use, and acquire tooling systems for CNC machines	F-3 Manually program CNC machines	F-4 Set and use tooling offsets at CNC machine	F-5 Use Computer-Aided-Manufacturing (CAM) system	F-6 Transfer files from CAM system to machine	F-7 Interconvert CAD and CAM files using DXF or IGES formats	F-8 Install and maintain file transfer systems	F-9 Configure CAM system parameters				
G	Perform Measurement/ Inspection	G-1 Know operation of O.D., I.D., and depth micrometers	G-2 Know operation of vernier, dial, & digital calipers	G-3 Read and use scale and tape measure	G-4 Know operation of dial-bore indicators	G-5 Know operation of dial indicators	G-6 Use precision square, center head, and protractor	G-7 Use digital read-out	G-8 Use finish/ profile gauges	G-9 Know operation of Rockwell hardness tester				
H	Demonstrate Communication Skills	H-1 Read, interpret, and apply memorandums, letters, and written instructions	H-2 Read, interpret, and apply technical reports, procedures and manuals	H-3 Communicate technical information verbally	H-4 Read, interpret, and apply graphs, charts, and other visual aids									
I	Perform Drafting/CAD Tasks	I-1 Demonstrate traditional mechanical drafting skills	I-2 Use Computer-Aided Drafting (CAD) system	I-3 Interconvert CAD and DXF or KIES formats	I-4 Generate and/or apply industry or company standards									

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	Duties	Tasks												
J	Use Computers	J-1 Use computer operating systems	J-2 Use file management systems	J-3 Perform backup on a personal computer	J-4 Understand RS-232 protocol	J-5 Use computer network system	J-6 Use file transfer systems	J-7 Understand and apply computer terminology	J-8 Have working knowledge of hardware components					
K	Manage Projects/Tasks	K-1 Compile and collate information	K-2 Conduct multiple project management	K-3 Set and maintain timelines	K-4 Prioritize tasks/duties/ projects	K-5 Preplan project activities	K-6 Demonstrate time/resource management							
L	Interpret/Use Blueprints and Related Documents	L-1 Interpret, review, and apply blueprint notes, dimensions, and tolerances	L-2 Interpret and understand basic layout/ types of drawings	L-3 Understand and analyze bill of materials	L-4 Ascertain job requirements from drawings	L-5 Interpret and apply geometric dimensioning and tolerancing								

SKILLS AND KNOWLEDGE
Communication Skills
Technical Reading/Writing Skills
Ability to Comprehend Written/Verbal Instructions
Leadership Skills
Organizational Skills
Knowledge of Company Policies/Procedures
Knowledge of Employee/Employer Responsibilities
Ability to Work as Part of a Team
Knowledge of Company Quality Assurance Activities
Knowledge of Safety Regulations/Responsibilities
Project/Task Management Skills
Logical/Systematic Problem Solving Skills
Computer Skills
Numerical/Mathematical Skills
Use Measurement Tools
Use Inspection Devices
Drafting Skills
Knowledge of Industrial Materials
Knowledge of Manufacturing Processes
Mechanical Aptitude

ITAWAMBA COMMUNITY COLLEGE MAST PROGRAM REPRESENTATIVES

Dr. Charles Chrestman
Dean/Director

Don Benjamin
Associate Dean/Site Administrator

Barry Emison
Site Coordinator

THOMAS LIGHTING REPRESENTATIVES

Dwayne Davis
Engineering Product Manager

John Mckinney
Draftsman

Carlton Plunk
Sr. Design Engineer

George Rutledge
Sr. Documentation Control Engineer

Dana Wallace
Engineer

Chris Warner
Design Engineer

Brad Wayoaster
Sr. Design Engineer

TRAITS AND ATTITUDES
Strong Work Ethic
Interpersonal Skills
Punctuality
Dependability
Honesty
Neatness
Safety Conscientious
Motivation
Responsible
Physical Ability
Professional
Trustworthy
Personal Ethics
Innovative

TOOLS AND EQUIPMENT

FUTURE TRENDS AND CONCERNS
Adaptive Controls
Composites
In-Process Gauging
Rapid Tool Changing
Expended Communication with Shop Floor
Multi-Axis Equipment
Computer-Integrated Manufacturing

COMPETENCY PROFILE

CAD / CAM Technician

Prepared By
M.A.S.T.
Machine Tool Advanced Skills
Technology Program
and
Consortia Partners
(V.199J40008)

THOMAS®
LIGHTING

CAD/CAM TECHNICIAN .... use computer based systems to create part geometry, draft layouts, produce drawings, and write, edit, and download code to CNC machines

	Duties	Tasks												
A	Practice Safety	A-1 Follow safety manuals and all safety regulations/ requirements	A-2 Maintain safe equipment and machinery	A-3 Maintain a clean and safe work environment	A-4 Ensure safe operation of machines	A-5 Use safe machining practices	A-6 Use safe lifting practices	A-7 Use safe operating procedures for hand and machine tools	A-8 Consult and apply MSDS for hazards of various materials	A-9 Practice proper tag-out/ lock-out procedures	A-10 Practice electrical safety procedures			
B	Apply Mathematical Concepts	B-1 Perform basic arithmetic functions	B-2 Interconvert fractions/ decimals	B-3 Interconvert Metric/ English measurements	B-4 Perform basic algebraic operations	B-5 Perform basic trigonometric functions	B-6 Use basic geometric principles	B-7 Calculate and apply formulas	B-8 Use and apply basic concepts of physics	B-9 Use and apply cartesian coordinate system				
C	Demonstrate Quality Control and Management	C-1 Utilize appropriate inspection techniques	C-2 Perform appropriate use and calibration of inspection equipment	C-3 Know qualitative parameters of machinery and equipment	C-4 Know and use TQM techniques	C-5 Know and use SPC techniques and concepts	C-6 Write inspection procedures	C-7 Have working knowledge of coordinate measuring machine	C-8 Document inspection results	C-9 Know operation of coordinate measuring machine				
D	Demonstrate Knowledge of Manufacturing Materials	D-1 Identify materials with desired properties	D-2 Know machinability/ workability of various materials	D-3 Know use of carbon index	D-4 Know stress relieving procedures	D-5 Demonstrate knowledge of heat treating procedures and properties	D-6 Determine, interpret, and evaluate availability of materials	D-7 Apply concepts of and calculate statics and stresses						
E	Demonstrate Knowledge of Manufacturing Processes	E-1 Know operation of vertical and horizontal mills and tooling	E-2 Know operation of engine and turret lathes and tooling	E-3 Know operation of drill presses and tooling	E-4 Know operation of surface and cylindrical grinders	E-5 Know operation of heat treating equipment/processes	E-6 Know operation of welding equipment	E-7 Know operation of ga cutting equipment	E-8 Know operation of punch / brake presses and tooling	E-9 Know operation of plate shears	E-10 Know operation of jig-boring machines and tooling	E-11 Know operation of tool and cutter grinders	E-12 Know operation of band and radial arm saws	E-13 Estimate time and/or costs of producing a part
		E-14 Calculate tonnages required for press operations	E-15 Calculate bend allowances / use yield tables for sheet metal operations	E-16 Apply conservation of material concepts	E-17 Establish standards and/ or rates	E-18 Utilize basic concepts and principles of fixturing	E-19 Utilize basic die theory	E-20 Demonstrate general knowledge of industrial painting concepts						
F	Perform CNC Programming/ CAM Tasks	F-1 Prepare and plan for CNC machining operations	F-2 Select, use, and acquire tooling systems for CNC machines	F-3 Manually program CNC machines	F-4 Set and use tooling offsets at CNC machine	F-5 Use Computer-Aided-Manufacturing (CAM) system	F-6 Transfer files from CAM system to machine	F-7 Interconvert CAD and CAM files using DXF or IGES formats	F-8 Install and maintain file transfer systems	F-9 Configure CAM system parameters				
G	Perform Measurement/ Inspection	G-1 Know operation of O.D., I.D., and depth micrometers	G-2 Know operation of vernier, dial, & digital calipers	G-3 Read and use scale and tape measure	G-4 Know operation of dial-bore indicators	G-5 Know operation of dial indicators	G-6 Know operation of Rockwell hardness tester	G-7 Use digital read-out	G-8 Use finish/ profile gauges	G-9 Know operation of precision square/center-head/ protractor	G-10 Know operation of multi-meter			
H	Demonstrate Communication Skills	H-1 Read, interpret, and apply memorandums, letters, and written instructions	H-2 Read, interpret, and apply technical reports, procedures and manuals	H-3 Communicate technical information verbally	H-4 Read, interpret, and apply graphs, charts, and other visual aids	H-5 Write technical reports, procedures, and guidelines								
I	Perform Drafting/CAD Tasks	I-1 Demonstrate traditional mechanical drafting skills	I-2 Use Computer-Aided Drafting (CAD) system	I-3 Create 3-D solid models	I-4 Use and apply GD&T methodology	I-5 Generate and/or apply industry or company standards	I-6 Interconvert CAD and DXF or IGES formats	I-7 Configure CAD system parameters						

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Duties		Tasks												
J	**Use Computers**	J-1 Use computer operating systems	J-2 Use file management systems	J-3 Perform backup on a personal computer	J-4 Use/Install software packages	J-5 Use computer network system	J-6 Use file transfer systems	J-7 Understand and apply computer terminology	J-8 Have working knowledge of hardware components	J-9 Understand and apply RS-232 protocol				
K	**Participate in Product Design Activities**	K-1 Design parts for manufacturability	K-2 Design parts for functionality	K-3 Design parts for marketability	K-4 Plan and design for "mating of parts"	K-5 Be cost conscious with design of parts	K-6 Incorporate safety into product design	K-7 Determine, interpret, and evaluate customer specifications	K-8 Design, document, and validate testing methods	K-9 Coordinate production of prototype				
L	**Interpret/Use Blueprints and Related Documents**	L-1 Interpret, review, and apply blueprint notes, dimensions, and tolerances	L-2 Interpret and understand basic layout/types of drawings	L-3 Understand and analyze bill of materials	L-4 Ascertain job requirements from drawings	L-5 Interpret and apply geometric dimensioning and tolerancing	L-6 Interpret and apply electrical schematic diagrams	L-7 Interpret and apply hydraulic or pneumatic diagrams	L-8 Understand and apply plant layout drawings	L-9 Interpret and apply ladder/digital logic diagrams				
M	**Manage Projects/Tasks**	M-1 Compile and collate information	M-2 Conduct multiple project management	M-3 Set and maintain timelines	M-4 Prioritize tasks/duties/projects	M-5 Preplan project activities	M-6 Demonstrate time/resource management	M-7 Perform research	M-8 Comprehend entire scope of project	M-9 Assess and evaluate / Revise or modify project layout				

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APPENDIX B - PILOT PROGRAM NARRATIVE

What follows is a narrative of the pilot program which was conducted for this particular occupational specialty.

July 31, 1996

Mr. Wallace Pelton
Site Coordinator
Texas State Technical College
3801 Campus Drive
Waco, TX 76705

Re: Testing of CAD/Drafting Students in the Pilot Program

Dear Mr. Pelton:

Every effort was made to fulfill the expectations of the MAST Pilot Project with respect to the pre- and post-testing process of Moraine Valley Community College's CAD/Drafting students. However, in order to fully appreciate the test outcomes, one must be familiar with Moraine Valley's program.

The CAD/Drafting program, at Moraine Valley, is an open enrollment program and generally follows the course material of the MAST Pilot program. Therefore, there is not an identifiable cohort of students who enter the program each year and matriculate through the program. In fact, many students enroll in only one course each semester and take several years to achieve their degree. As a result, only 16 new students were available to be administered the pre-test in the Fall of 1995. As a group, the test scores ranged from 29% to 45% with an average score of 35.9%.

Upon completion of the first semester, 13 students achieved a 70% or better on their exit exam and 8 of these students proceeded to the next level of courses in the 1996 Spring semester.

Please feel free to call me if you require further clarification on the testing process.

Sincerely,

Richard A. Kukac
Associate Dean
Business and Industrial Technology

For more information:

MAST Program Director
Texas State Technical College
3801 Campus Drive
Waco, TX 76705

(817) 867-4849
FAX (817) 867-3380
1-800-792-8784
http://machinetool.tstc.edu